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Daar de proefschriften in de reeks van de Faculteit Economie en Bedrijfseconomie het persoonlijk werk zijn van hun auteurs, zijn alleen deze laatsten daarvoor verantwoordelijk

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Conferences and publications

Presentations at conferences

The chapters benefited from comments of several conferences. Chapter 1 was presented at the CEPR conference on 'regional development at the periphery: theory, policy and measurement' in Glasgow, the European Accounting Association conference(EAA) in Göteborg, the research day in accounting at the university of Antwerp and the conference of the 'Vlaamse vereniging voor Economie' in Brussels. Moreover, chapter 2 benefited from the comments of the LICOS seminar participants and was published in 'De Economist' vol 153 number 3.

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Chapter 3 was presented at the summer school on fiscal federalism in Barcelona, the European Trade Study Group conference (ETSG) in Athens, the 'Journée de l'oligopole' of CORE- Ecole Polytechnique in Paris, an informal LICOS seminar at the KULeuven, an informal IEG seminar at UCL and a formal seminar at the university of Brussels (VUB).

Finally, chapter 4 benefited from the comments of the LICOS seminar participants and was presented at the European Trade Study Group conference (ETSG) in Dublin, the PhD workshop at Bocconi University of Milan, the CEPII Doctoral meetings in international trade in Geneva, the doctoral workshop of UCL, the Midwest trade meetings in Minneapolis and the conference on "Economic Analysis of Heterogeneity in Social Organizations" at UCL.

Publications

Some chapters of this dissertation have led to publications in several journals or working paper series.

Publications in Journals

Vandenbussche, H., Janssen, B., Crabbé, K. (2005). Regional tax competition. Firm level evidence for Belgium. *De Economist*, 153(3), pp 257-276.

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Vandenbussche, H., Crabbé, K. (2004). Betalen alle grote Belgische bedrijven evenredige belastingen op hun winst? *Accountancy & Bedrijfskunde*, 24(8).

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Publications in working papers

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Vandenbussche, H., Janssen, B., Crabbé, K. (2004) Is there Regional Tax Competition in Belgium? *DTEW discussion paper K.U.Leuven*, nr. 0421

Janssen, B., Vandenbussche, H., Crabbé, K. (2005) Corporate tax savings when hiring a big 4 auditor: Empirical evidence for Belgium. *DTEW discussion paper K.U.Leuven*, nr. OR0541

Vandenbussche, H. and Crabbé, K. (2005) Vennootschapsbelasting: positie van België in het verruimde Europa. *DTEW discussion paper K.U.Leuven*, nr. OR 0562

K. Crabbé and M. Beine (2008) Trade Integration, Institutions and Export Specialization, *LICOS discussion paper*, forthcoming

General Introduction

The purpose of this dissertation is to closely analyze corporate tax competition in Europe. Whereas most of the existing literature explores corporate tax competition from a country level perspective, this dissertation takes a different approach. First, I analyze corporate tax competition between regions within the borders of one country. And second the spatial dimension of corporate tax rates in the EU is studied. For the first time the new member states of the European Union (EU) are taken into account. In addition, this thesis analyzes to what extent trade and/or taxes have contributed to export specialization in Central and Eastern Europe.

This dissertation is divided in two parts. In a first part, I study whether there is evidence of regional tax differences within countries. Whereas the literature typically studies corporate taxes on the country level, in countries with large regional disparities in terms of economic activity and development, like Belgium and Italy, these differences can give rise to regional tax heterogeneity. That is, while an identical firm belonging to a particular country is subject to the same corporate tax rate, there can be regional differences in the tax base. Tax audits are another potential source of regional tax differences as they tend to take place at the regional level rather than at the national level. When the enforcement policy can differ across regions, taxes will be lower in the low enforcement region (Moesen et al. (1994), Amerighi (2006), Peralta et al. (2006)). Especially regions that find it harder to attract firms due to disadvantageous geographical or economic conditions, may opt for a milder enforcement policy, allowing for more expenses to be deducted and firms to pay less taxes. To study regional tax heterogeneity, I look in chapters 1 and 2 to the case of Belgium and Italy.

My results seem to confirm that firms in poorer regions tend to pay fewer taxes.

In the second part of this thesis, I shift the focus from regional tax competition to corporate tax competition between countries. For corporate taxes in the EU, only a small set of articles has analyzed strategic competition. A first study is by Altshuler & Goodspeed (2002). They show that EU countries strategically compete in corporate taxes with geographically close countries and to a lesser extent with the US. Redoano (2003) concludes that tax competition mainly occurs between geographically close countries using corporate tax rates for 13 European countries during the period 1980-1995. A third study looking exclusively at EU15 countries is from Ruiz & Gerard (2007). These authors find only weak empirical evidence of strategic tax competition in the EU15 during the period 1989-2001. My work however contributes by focussing on the introduction of Central and East European countries in the EU and its implications on country level taxation issues.

I revisit the question to what extent there is a spatial dimension in corporate tax competition in the EU. That is, could it be that countries like Germany and Austria, which are neighboring the low tax region of Central and Eastern Europe, are subject to stronger tax competition than say France or Belgium, located at a greater distance of the low tax new member states? I explore these issues by estimating different fiscal reaction functions depending on the distance to the low tax region Central and Eastern Europe. Our econometrical analysis finds evidence of the presence of such spatial pattern in corporate taxes in the EU. The subsequent chapter on the new EU member states discusses the trade behavior of the new EU member states in their relation to the EU15. I investigate whether there is a link between trade liberalization, tax differences and institutions on the one hand and export specialization in Central and Eastern Europe on the other hand. I provide evidence that both trade liberalization and institutions influence their export specialization, while taxes do not contribute to export specialization in Central and Eastern Europe.

In the next section, I give a short overview of the contents of the different chapters of this dissertation. Chapter 1 uses a large firm-level data set on Belgian firms to test which firm characteristics matter in explaining

effective tax rates. The results are indicative for the presence of regional tax differences, with a lower effective tax rate in the southern region Wallonia than in the northern region Flanders. More precisely, the effective tax rate in Wallonia is about 6 percent[1] lower than in Flanders. I also find that the average effective tax rate of capital region Brussels is also lower than Flanders. A possible explanation for this is that Brussels had more coordination centres[2] (1.2%) and foreign owned firms (29.94%) in the period of my analysis than the other regions. As for sectoral differences, this study shows that Flanders has relatively low taxes in sectors such as tourism, recycling and research & development, while sectors such as tobacco have a higher than average rate. In some cases the below average effective tax rate can be a reflection of the statutory tax concessions that firms in these sectors enjoy, like in the case of the recycling-sector, in other sectors political factors probably matter as well. Interaction effects between the sector and the region a firm is located in show that Brussels has significant lower effective tax rates for firms in the leather and shoe industry and Wallonia in textiles, leather and shoe industry compared to Flanders. In contrast, the recycling sector in Brussels has a significant higher effective tax rate than on average. A final observation for Belgium is that effective tax rates have steadily increased over the period 1993-2002. Especially at the end of the nineties, when a new government took office, the average effective tax rate increased substantially. One possible explanation is that this government anticipated the strong reduction in the statutory tax rate it introduced in December 2002. By widening the tax base in the years just before that reduction, the effect on the country's budget is at least partly offset and the impact on the budget dampened[3]. From this study I conclude that the Belgium tax system is not neutral across all firms as there are important regional tax differences in Belgium.

[1] This percentage is based on the estimation in column (1) of Table2 and is calculated as follows: The coefficient of the dummy Wallonia is 0.015 percentage points and the average ETR of the sample is 0.2615 percentage points. Therefore, I can say that the ETR in Wallonia is 6 percent lower than the ETR in Flanders.

[2] A coordination centre is part of a multinational group, is involved in activities such as financial or business support services and gets a lower tax base than domestic firms.

[3] This result still holds when controlling for the value added by the firm.

In chapter 2, Italy is another example of a country with large regional differences. Moreover, its corporate tax rate exists of a tax on corporate profits (IRPEG) and a tax on value added of business activities (IRAP), where the regions can manipulate this 'IRAP' independently. Therefore, the effective tax rate can differ across regions because of a different 'IRAP' rate, but also because of region-specific tax incentives. As a consequence, this chapter can analyze the impact of firm characteristics on the effective tax rate of Italian companies. Therefore, this chapter analyzes the impact of firm characteristics on the effective tax rate of Italian companies. In addition, it studies whether Italian regions set their tax rates strategically. First, this study observes that companies in southern and mountain regions Basilicata, Campania, Sicilia, Sardegna, Abruzzo, Lazio and Valle D'Aosta have a significantly lower effective tax rate than the overall average effective tax rate of 47.8 percent for the period 1993-2003. I also find empirical evidence of strategic tax competition Italian regions for the effective tax rate and for the IRAP rate is present. This implies that regional tax differences can also be the result of strategic competition between regions.

Chapter 3 formally tests the presence of strategic tax settings in the old EU15 as a reaction to changes in the corporate tax rates in the new member states. First, a simple model of spatial tax competition is developed. This model predicts an inverse relationship between how close old member states are in geographic terms from the new member states and the toughness of tax competition. Empirically, the results show that indeed corporate tax competition is stronger for countries relatively closer to the low tax region of the new member states like Germany and Austria than for old member states further away from the new member states such as Spain, UK and Portugal.

Chapter 4 analyzes the role of corporate tax rates in the export specialization of Central and East European countries. Theory has shown that a government can use fiscal policy to promote specialization in a few sectors. Certain tax incentives can stimulate production and export. With respect to specialization, traditional and new trade theories predict increasing specialization as trade costs are reduced. Moreover, a growing literature points out the importance of institutions for trade and economic performance. This

chapter analyzes the empirical link between corporate taxes, trade integration, institutions and export specialization at the country level. For a set of thirteen Central European countries over the period 1989-2000, the results show the importance of trade integration and institutions on export specialization. That is, I find that a reduction in tariffs between EU15 and Central Europe leads to increased export specialization in Central Europe. In addition, institutions stimulating enterprise reforms such as credit and subsidy policies, speed up export specialization. Surprisingly, I find no evidence of the role of corporate taxes.

Chapter 1

Corporate Tax Differences in Belgium: Firm Level Evidence

1.1 Introduction

Closer economic integration in the EU has increased capital mobility and is considered responsible for the greater tax competition between countries. It has been argued that capital mobility will lead to a race to the bottom in corporate tax rates as countries compete with each other to attract firms (Commission 1998). To do so, governments have several tools at their disposal. They can either lower the statutory tax rate (STR), or they can narrow the tax base for firms. Kind et al. (2002) show that economic integration makes the corporate tax base increasingly mobile and tax sensitive, with downward pressure on tax rates as a result. Governments may also target specific companies or sectors and offer them a preferential tax treatment or specific tax privileges (e.g., investment credits or tax rulings for foreign investors). Alternatively, they may also decide to alter the fre-

[0]This chapter is based on co-authored work with H. Vandenbussche and B. Janssen and was published as Vandenbussche, Crabbé and Janssen (2006), 'Regional tax competition. Firm level evidence for Belgium', De Economist, vol. 153(3), p257-276. (Vandenbussche et al. 2005)

quency and intensity of tax audits. More intensive tax auditing will make firms more aware of their income declaration and is likely to increase the tax base and the amount of taxes collected. This would show up in the "effective tax rate" (ETR) which as opposed to the "statutory tax rate" (STR), also accounts for the tax base. As we will explain below, the difference between the STR and the ETR is a reflection of the number of tax concessions a country provides. In this paper we analyze the determinants of firm level ETR for large Belgian firms. While the statutory tax rate is the same for all these firms, there is substantial heterogeneity in Effective Tax Rates[1]. Our analysis indicates that while tax concessions explain some of the variation in Effective Tax Rates, a large part of the variation can be attributed to other more political factors, such as the size of a firm and the region it is located in. Sector membership and the federal government in office also turn out to be important factors in explaining the heterogeneity in ETRs. These more political factors could reflect either negotiated tax concessions or certain political and economical objectives that a government is aiming to achieve through its tax system. We find an average ETR of about 26%, which is 14% lower than the STR of 40.17% in that same period. While the STR did not change in the period we analyze, we do observe yearly changes in average ETRs. Our results suggest that the average ETR has steadily increased in the course of the nineties. Especially in the two years preceding the reduction in STR, we observe an increase in ETRs during the same government period. One possible explanation for this is that the government anticipated the strong reduction in STR it enacted in December 2002[2]. By widening the tax base in the years just before that reduction, the effect on the country's budget is at least partly offset and the impact on the budget dampened. In view of the Maastricht criteria and the Stability pact governments are forced to maintain budgetary discipline. Therefore when governments plan a lower

[1] A few other studies have analyzed firm level ETRs using different data sets such as Buijinck et al. (2002), Buijinck et al. (2000), Huizinga & Nicodème (2006), Janssen (2003) and Nicodème (2002).

[2] Belgium recently lowered its STR from 40.17% to 33.9% from the year 2003 onwards. Many other EU countries have also lowered their STR. For example the STR of Italy was reduced from 52.20% in 1993 to 40.25% in 2002. For Denmark the STR decreased from 36% in 1993 to 30% in 2002 (KPMG 2006).

tax rate, widening the tax base is one way to sustain the level of tax revenue. Hence, our results of increasing ETRs, especially at the end of the nineties, may pick up an anticipatory effect of the decrease in the STR in 2002[3]. This is also confirmed by the macro-economic study of Baldwin & Krugman (2004). They find that while most European countries have lowered their STRs, the ratio of 'aggregate Tax income at the country level over GDP' did not change much over time. Despite the reduction in nominal tax rates the total tax income at the country level remained relatively stable, suggesting that most countries had also widened their tax base. Although it is clear that in many countries in Europe, regions within a country can differ substantially in terms of their economic development and attractiveness to firms. Belgium is a typical example of a country where the economic situation of its 3 regions is very different. While the 3 regions Flanders, Wallonia and Brussels are relatively autonomous politically, their fiscal policy is still very much a federal issue. However, with an average unemployment rate of about 8% in Flanders compared to about 14% in Wallonia, the demand for an autonomous fiscal policy is growing. In a wider European context, economists have been arguing that more peripheral countries such as Greece and Portugal for example should be allowed to charge a lower corporate tax rate in order to differentiate themselves from the 'core' countries in Europe for the purpose of attracting firms within their country borders. This argument rests on the notion that firms in the core countries are more willing to pay higher taxes in return for better infrastructure, proximity to consumer markets, to suppliers and to other firms to benefit from agglomeration spillovers. Baldwin & Krugman (2004) for example have shown that tax revenue over country GDP has not converged in Europe between the so called 'core' and 'periphery' countries. In this paper we examine whether within a country such as Belgium with large economic disparities between its regions[4], there is any evidence of regional tax competition where the expectation would be that the more peripheral region of Wallonia would have a lower effective tax rate than the 'core' region Flanders. From a statutory point of view, firms

[3]Devereux et al. (2002) also find that tax-cutting and base-broadening reforms usually go hand in hand leaving the Effective Tax Rates fairly stable over time.

[4]There are many other countries in Europe that consist of regions with very different economic growth rates i.e. Italy, Germany and the UK amongst others.

in Flanders, Wallonia and Brussels are subject to the same STR and the same rules for the determination of the tax base apply. However, tax audits and controls are decentralized. There are about one hundred and fifty four regional tax offices scattered across the country responsible for tax audits and controls. Previous research has shown that the efficiency of these regional offices tends to differ substantially. More in particular Moesen et al. (1994) used non-parametric techniques and developed an efficiency index for each regional office where 'efficiency of tax controls' was measured by a number of variables including 'the number of files handled', the 'complexity of the file' and the number of 'visits on the premises'. The findings obtained in our paper suggest lower ETRs in Wallonia, compared to Flanders after controlling for sectoral composition and firm characteristics. This confirms the results by Moesen et al. (1994) but in addition points out that these efficiency differences mainly seem to occur along regional lines with lower efficiency and enforcement in the Walloon area. A possible explanation for that is the higher regional unemployment rate in Wallonia which puts this region in a weaker position vis-à-vis foreign investors and domestic firms, which may result in lower enforcement. The remainder of this paper is structured as follows: the next section gives an overview of related literature of the relevant statutory and accounting aspects of Belgian corporate taxation. Section 2.3.3 gives a brief review of the different measures of ETR. The collection and analysis of the data are discussed in Section 2.4. In section 1.5 we show some descriptive statistics. In section 1.6 we introduce the empirical model and in Section 1.8 we discuss the main results. Section 2.7 consists of some robustness checks. The last section concludes and summarizes the main results.

1.2 Belgian Statutory Framework

In this section we explain the determinants of the statutory tax base and the statutory tax concessions that applied in our period of investigation 1993-2002. The corporate income tax system in Belgium has a stepwise progressive tax rate system with rates ranging from 28% up to 40.17%. All Belgian firms in our sample are large firms subject to the highest STR. By

considering firms that fall within the same tax bracket, we control for the level of the STR in our analysis. Hence when we observe heterogeneity in ETRs between firms, other factors than the STR must be responsible for these observed differences. While we do not observe the tax base in our data, we do observe the yearly profits by each firm, which is taken by the tax authorities as the starting point for determining the tax base. The statutory tax base is determined as follows. First, from the annual income/profit figures that firms report, the tax authority can reject a number of expenses, which are not deemed to be true expenses of the period. This would enlarge the tax base. Secondly, firms can get a tax privilege for dividends received from Belgian or foreign firms (EU or non-EU) to avoid double taxation of dividend income[5]. Thirdly, they can get a tax break for losses reported in the past ('carry-forwards')[6]. And finally, statutory tax concessions are also granted for four types of investments: investments in patents, investments in research & development, investments in energy-saving technology and other investments[7]. The extent to which expenses are rejected by the tax authority, as well as some of the statutory or negotiated tax concessions a company enjoys can not be observed in our data. However, we do know the total corporate 'tax liability' of the firm in a particular year. A generally accepted way of measuring the effective tax rate (ETR) is by relating the firm level 'tax liability' to the 'profits before tax' (Buijinck et al. 2002). The extent to which the ETR differs from the STR is indicative of how the tax base differs from the reported 'profits before taxes' in our company accounts data. If the effective rate lies below the statutory rate, which on average is the case, the tax base is smaller than the reported earnings and the firm enjoys statutory or negotiated tax concessions and tax rulings.

[5]When the dividend is at least 5% of the disbursing companys capital, 95% of the dividend revenue is free of Belgian corporate tax (Kerchove & Heirewegh 2003). For dividends between parent and subsidiaries (minimum participation of 25%) in the European Union, the EU Parent-Subsidiary directive applies (Commission 2000).

[6]The taxable income may be reduced with the losses of the previous periods. In Belgium only losses can be deducted from future profits, this is called carry-forward of losses (Kerchove & Heirewegh 2003).

[7]For the period we analyze (1993-2002), the tax concession for each of these investments was 13.5% on the cost of the investment.

1.3 Effective Tax Rates

Effective Tax Rates can be computed in various ways. The measures used in the literature differ from each other in two respects: the aggregation level of the data (micro- versus macro data), and the historic versus future orientation of the methods. The somewhat older literature has looked at Effective Tax Rates based on macro-economic data by relating 'tax revenue' to a country's 'Gross domestic product' (GDP). The downside of this approach is that with aggregate macro-economic data one cannot analyze firm- and sector-level heterogeneity in effective tax rates. More recent studies use more micro-level data and define the effective tax rate at the firm level. In view of our access to financial statements data, our preferred approach in this paper is the micro-level one, allowing us to study firm and sector heterogeneity in the Belgian tax system. The other difference in the use of Effective Tax Rates is the time orientation and the real-life nature of the data used. Backward-looking tax rates use historic real-life data to estimate the tax burden of a company while forward-looking tax rates consider the tax burden associated with future hypothetical investment decisions. While the advantage of a backward-looking effective tax rate is that it is relatively easy to construct, its use does not only reflect a country's tax incentives embedded in the law but also reflects a country's enforcement policy (Nicodème 2002). The forward looking method considers the tax burden on a hypothetical investment project[8]. This approach was first developed by King & Fullerton (1983) and is particularly suited to investigate firms' future incentives to invest given a particular tax structure. However, the use of forward looking rates is more complicated to implement empirically because its calculation relies on a hypothetical and specific type of investment, using a specific source of financing. Therefore, the forward tax rate does not take on board all aspects incorporated in a country's tax system[9]. In view of the research questions we analyze in this paper and the data that we have at our disposal, we opted for the micro backward looking effective tax rate method where the effective tax rate (ETR) is defined as the ratio of firm

[8]For a good discussion of the forward looking rates we refer to Devereux et al. (2002).

[9]In Devereux et al. (2002) the type of investment considered is on plant and machinery financed by equity.

level corporate taxes in a particular year over the profits in that same year. This ETR will be used as the dependent variable in our empirical model, where the right hand side variables will consist of firm characteristics, sector dummies and location variables. A possible endogeneity problem that is inherent when using the backward-looking effective tax rate will be overcome by lagging some of the firm level investment variables as explained in section 1.1.

1.4 Data

We use a rich panel dataset of 12,197 large Belgian firms over a period of 10 years from 1993-2002, which results in more than 100,000 observations. These data were obtained from a commercial database BELFIRST which contains the population of Belgian firms. In view of the progressive nature of the corporate tax system in Belgium, we decide to include only the large firms in both manufacturing and non-manufacturing industries. Or, in other words, we included firms that are subject to an STR of 40.17% or above in the period we analyze[10]. By only considering firms in the highest tax bracket we control for the level of STR. Any difference in Effective Tax Rates we observe in the data therefore stem from other factors than the STR. We excluded financial institutions such as banks and insurance companies, because they are subject to a different set of accounting rules and reporting standards. Our analysis is based on unconsolidated company accounts[11] and we do not include negative ETR observations and effective taxes higher than 100% as in Collins & Shackelford (2003). The regional composition of the data is as follows: 22.5% of the firms in our sample are located in Brussels, 16% in Wallonia and 61% of the firms is located in Flanders. While the BELFIRST data set contains data for the years 1989 to 2002, the availability varies between years. Especially, the availability of data for the years 1989-1992 is very limited. Therefore, we decided to focus on the

[10] According to the EU directive, a company is large when it has on average more than 100 employees or when it exceeds one of the following criteria: employees > 50, sales (VAT exclusive) $> 6\ 250\ 000$ euro, total assets $> 3\ 125\ 000$ euro.

[11] In Belgium there is no fiscal consolidation, hence the unconsolidated accounts are used to determine tax liabilities.

period 1993-2002 for our analysis.

1.5 Descriptive Statistics

In the literature the effective tax rate (ETR) is referred to as a micro backward-looking measure of corporate tax pressure (Devereux et al. 2002). This variable will be our dependent variable in the regression analysis in the next section. Table 1.1 presents some descriptive statistics (mean, median, standard deviation) for the ETR per region. A first observation is that while the ETR for large Belgian firms is 26%, the median ETR is somewhat higher and lies around 29%. A study of Buijinck et al. (2002) finds an average ETR for Belgium of 21.64%, which is pretty similar to our findings. Second, while in principle all large Belgian firms are subject to the same statutory tax rate, the standard errors in Table 1.1 indicate that there seems to be substantial firm heterogeneity in ETRs. Also, on the basis of Table 1.1 we would be inclined to conclude that the average ETR in Wallonia and Brussels is somewhat lower than for Flanders. The median ETRs are even more suggestive of regional tax differences. The very low median ETR for Brussels is probably due to the high number of coordination centers that are residing in Brussels[12]: 1.2% of the companies in Brussels are coordination centers, while this is only 0.61% and 0.38% of the companies in Flanders and Wallonia respectively. Therefore, at this stage in the analysis we can not exclude the possibility that these regional differences in Table 1.1 are due to coordination centers or to a different sectoral composition of the regions. In the regression analysis in section 1.7, we will test for significant differences in ETRs between regions in a more formal way.

Figure 1.1 gives an overview of the average ETRs per Nace-Bel 2-digit level sector and per region. The bold vertical line in Figure 1.1 represents the overall average ETR across sectors. We note that there is a lot of heterogeneity between sectors within one region. Also within one sector there is substantial variation in ETR depending on the region the firm is located in. Flanders has relatively low taxes in sectors such as tourism

[12] A coordination center is part of a multi-national and involve activities such as financial or business support services and get a lower tax rate than domestic firms.

Table 1.1: Average Effective Tax Rates by Region, Belgium

ETR1	Flanders	Wallonia	Brussels	Total
Mean	0.2699	0.2594	0.2402	0.2615
median	0.3239	0.2767	0.1579	0.2917
std. dev.	0.2537	0.2467	0.2583	0.2464
N observations	58,816	15,406	21,546	95,768

(hotels), recycling and research & development (R&D), while sectors such as tobacco have a higher than average rate. In many sectors the effective tax rate (ETR) in Wallonia is lower than the one in Flanders (telecom, real estate, metals, cokes, clothing, chemicals, rubber). But notably in IT, furniture, utilities, transportation and office supplies, the ETR is higher in Wallonia than in Flanders. While in some cases the below average ETR can be a reflection of the statutory tax concessions that firms in these sectors enjoy, like in the case of the recycling-sector, it is far less easy to explain the average ETR level in other sectors. One possible explanation is that the government through the tax system is either encouraging or discouraging certain activities. In the regression analysis in section 1.7 we will include 33 sector dummies to control for sector effects in addition to firm characteristics to explain the variation in firm level ETRs[13].

1.6 The Model and Variable Definitions

The empirical model we introduce in this section closely follows the literature by including firm characteristics and sector dummies to explain firm level ETRs Huizinga & Nicodème (2006); Nicodème (2002); Gupta & Newberry (1997); Buijinck et al. (2000), Buijinck et al. (2002). In addition to this literature we also include year dummies, location dummies and statutory tax concessions. The empirical specification we test has the following general

[13] In the regressions in section 1.7, we include 33, 2-digit NACE-BEL sector dummies where we drop the 'Optical & Clockworks'-sector, because its ETR is closest to the average ETR across all sectors. The sector dummies should therefore be interpreted relative to the average ETR in 'optical & clockworks'.

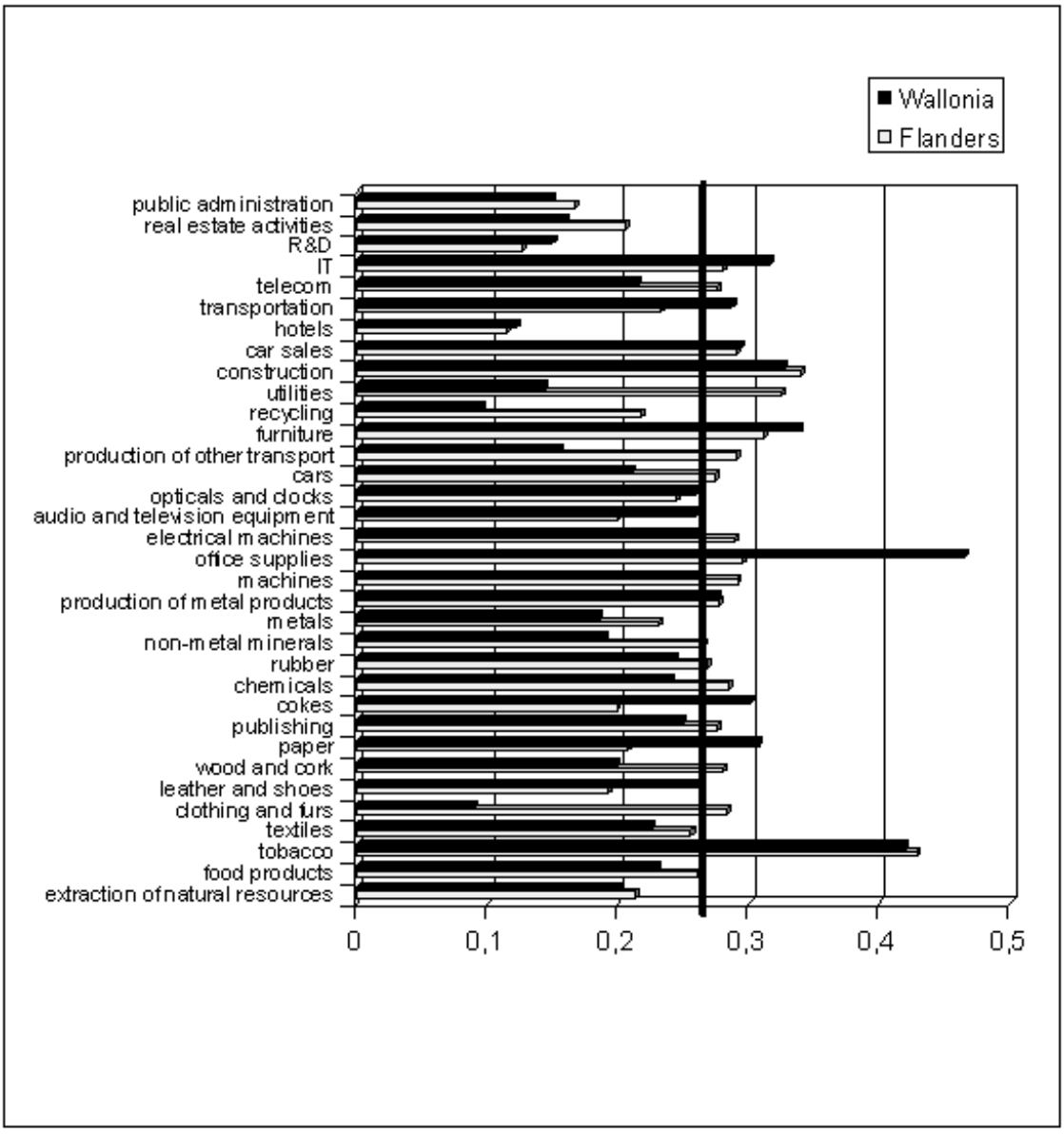

Figure 1.1: Heterogeneity in average Effective Tax Rates in Belgium

form,

$$\begin{aligned} etr_{it} &= \beta_0 + \beta_1 firmsize_{it} + \beta_2 statutory_{it} + \beta_3 region_i \\ &\quad + \beta_4 year_t + \beta_5 sector_i + \xi_{it} \end{aligned} \tag{1.1}$$

where the dependent variable, ETR, is the effective tax rate of firm i in year t.

In the literature firm size has predominantly been measured by the log of total assets. According to Gupta & Newberry (1997) there are two opposing theories regarding the effect of firm size on firm level ETRs. On the one hand, the 'political cost theory' argues that large firms have a higher visibility which means they are more scrutinized which may result in higher tax burdens. As a consequence larger firms face higher ETRs. On the other hand there is 'the political power theory' that argues that larger firms have greater resources to influence the political process and therefore larger firms are expected to face lower ETRs. Nicodème (2002) uses 'turnover' as a size variable. Theoretically he derives a positive relationship between a firm's turnover and its tax liability, suggesting that bigger firms would pay more taxes. However, empirically he finds a negative relationship between size variables and tax liabilities, suggesting that larger firms pay lower taxes. In view of the ambiguous results for the different size variables in the literature, we will proxy size by using both the log of total assets and the log of total employment (employment) as different proxies for size in our specifications. We further include a set of variables accounting for a number of statutory tax breaks (statutory) such as: capital intensity (capital intens), long term leverage (Ltleverage) and R&D expenses (R&D intens). The capital intensity (capital intens) of a company is defined as the ratio of fixed tangible assets over total assets. This variable can affect ETR through the tax treatment of depreciation[14] or through the tax breaks for investments (see footnote 7). Long-term leverage is defined as the ratio of long-term debt over total assets. One reason for including this variable is that interest payments on debt are fully deductible as long as the creditor is a financial company institution Kerchove & Heirewegh (2003). As discussed above,

[14]Depreciation is an expense of the period and lowers the tax base.

there is also a tax concession for R&D investments and patents. This is the main reason for including the R&D intens variable which is defined as the ratio of intangible fixed assets over total assets. Another variable controlling for statutory tax concessions is a dummy variable with a value of 1 if a firm is a coordination center (coord. center). All variables in the statutory-group are expected to lower the effective tax rate of the company. To control for regional differences in ETRs we include two regional dummies. One with a value of 1 if a firm is located in Brussels and zero otherwise and one with a value of 1 if a firm is located in Wallonia and zero otherwise (Flanders is the reference variable). To analyze the yearly evolution of ETRs over the period we include 9 year dummies (y1994-y2002) with 1993 as the reference year[15]. Finally to control for sector heterogeneity we include 33 sector dummies at two-digit Nace-Bel level. We also include an error term (ξ_{it}) to control for white noise. In the next section we report the results of an Ordinary Least squares (OLS) regression where we take into account that firm observations in consecutive years are not independent observations which may result in autocorrelation. Therefore we use a cluster estimation technique that clusters firm observations over time using a unique company identifier. 'Clustering' controls for the possible autocorrelation of firm observations over time. In addition we use a 'robust' regression technique to control for potential heteroskedasticity[16]. This renders the standard errors into robust standard errors. As a robustness check in section 1.8, we will use a fixed effects specification where we allow for a firm-specific intercept. This implies that in expression 1.1, β_0 is replaced by β_i where subscript i refers to an individual firm. By including an intercept for each individual firm, we implicitly control for firms specific factors that are unobservable or not included in our analysis but that may affect the effective tax rate and which is quite common to use in micro-econometrics using firm level data. Examples of firm level fixed effects are the ability of the manager, the quality of the auditor, the political clout of a firm, etc.

[15]We have also experimented with including the age of a firm, but this variable never turned out to be significant and was therefore dropped from the analysis.

[16]In the 'robust' regression technique our statistical software package STATA uses the Huber/White/Sandwich estimator of standard errors

1.7 Empirical Results

In this section we discuss our main results. Table 1.2 reports the main OLS regression results for model (1), using all observations for the period 1993-2002. In column (1) we use the logarithm of total assets as a firm size variable, while column (2) gives the same regression but where we use the log of employment as a proxy for firm size. While the level of 'employment' consistently shows up with a positive and significant coefficient, this is less the case with 'total assets', where the sign and significance is much more sensitive to the type of specification used. In view of these ambiguous results, it is hard to draw strong conclusions regarding the relationship between firm size and the effective tax rate. The only conclusion that is relatively robust is that Belgian tax incentives seem to go against the interests of labor intensive firms, since higher employment levels are associated with higher ETRs.

More encouraging is that all the statutory-variables come with the expected sign. Highly leveraged firms with many interest expenses have lower ETRs, as well as firms that invest in R&D. Capital intensive firms have lower ETRs as a result of higher depreciations. Also, we find evidence of regional tax competition. Both Brussels and the dummy for Wallonia are negative and significant, suggesting a lower average ETR in these regions than in Flanders. Note that this regional difference is obtained after controlling for sector composition and firm characteristics which may be different between the two regions. The results in Table 1.2 also confirm that firms in coordination centers have a lower ETR. The year-dummies we included are all positive and significant. This suggests that corporate tax burden has been rising since 1993. The coefficients indicate that the strongest increase has occurred in the most recent years. More in particular in the three years before 2002, the year in which the STR was reduced to 33.99%[17], the effective tax rate rose substantially. From 1999 onwards, the year when a new government took office that promised tax rate reductions, the Effective Tax Rates rose most substantially. A possible explanation is that during that period, the tax base was widened gradually, to anticipate the large reduction in STR that the same government enacted at the end of its term in office in

[17]The reduced STR applied from the fiscal year 2003 onwards.

December 2002[18].

One drawback of our approach is that there is potential endogeneity problem in the sense that low ETRs may give rise to lower levels of some of the firm level investment variables. The appropriate way to address this is to use instruments, typically the variable lagged by one year. In column (3) of Table 1.2, we run a specification where we use lagged values of total assets in the denominator for the right hand side variables possibly causing the endogeneity (capital intens, LTleverage, R&D intens). Both the regional effects (lower ETRs for Brussels and Wallonia than in Flanders) and the rising ETRs over time especially in the years prior to 2002, go through, suggesting that this potential endogeneity problem is not too serious.

Some authors have used a different definition of the effective tax rate. Huizinga & Nicodème (2006) have used the ratio of 'Income Tax' over 'total Assets'. Column (4) of Table 1.2 shows the results of model (1) where we use this definition of ETR (etr2). The firm size variable 'total assets' now becomes negative and significant, but most of our results are robust to the use of etr2 as a dependent variable. However, the dummy for Brussels turns insignificant, while the dummy for Wallonia continues to be negative and strongly significant. In our view etr2 is somewhat less suited to capture the extent of tax concessions, since there is no direct link between a firm's total assets and the tax rate it is subject to, which is why our preferred specification remains the ones with etr1 as a dependent variable. Also the use of etr2 can induce endogeneity problems as many right hand side variables of the model specification in (1) are also scaled by total assets. Again using lagged values of total assets in the denominator for the right hand side variables possibly causing the endogeneity (capital intens, LTleverage, R&D intens) did not change our main findings, but will not be reported here for brevity.

[18] Also in other European countries reductions in STR have coincided with an enlargement of the tax base (Devereux et al. 2002).

Table 1.2: Main Regression Results

	(1) Assets	(2) Employment	(3) Lags	(4) etr2
Total assets	0.003*	-	-	-0.002***
	[0.002]			[0.003]
Employment	-	0.016***	0.017***	-
		[0.002]	[0.002]	
Ltleverage	-0.007***	-0.008**	-0.00001**	-0.0006
	[0.002]	[0.004]	[4.78e-06]	[0.0006]
Capital intens	-0.05*	-0.05*	-0.00002*	-0.007*
	[0.027]	[0.028]	[0.00001]	[0.004]
R&D intens	-0.24***	-0.249***	-0.00004	-0.023***
	[0.03]	[0.036]	[0.0001]	[0.004]
Coordin. cenre	-0.123***	-0.148***	-0.133***	-0.006***
	[0.029]	[0.028]	[0.027]	[0.002]
Brussels	-0.017***	-0.019***	-0.021***	0.0002
	[0.007]	[0.008]	[0.01]	[0.001]
Wallonia	-0.015**	-0.017***	-0.019***	-0.003***
	[0.007]	[0.007]	[0.007]	[0.001]
Y1994	0.014***	0.017***	0.018***	0.002***
	[0.006]	[0.006]	[0.006]	[0.001]
Y1995	0.014***	0.015***	0.017***	0.003***
	[0.006]	[0.006]	[0.006]	[0.001]
Y1996	0.018***	0.02***	0.022***	0.003***
	[0.006]	[0.006]	[0.007]	[0.001]
Y1997	0.02***	0.022***	0.025***	0.004***
	[0.006]	[0.007]	[0.007]	[0.001]
Y1998	0.028***	0.028***	0.031***	0.006***
	[0.006]	[0.007]	[0.007]	[0.001]
Y1999	0.037***	0.035***	0.040***	0.007***
	[0.006]	[0.007]	[0.006]	[0.001]
Y2000	0.037***	0.034***	0.041***	0.007***
	[0.007]	[0.007]	[0.007]	[0.007]

Table 1.2: Main Regression Results, continued

	(1) Assets	(2) Employment	(3) Lags	(4) etr2
Y2001	0.038***	0.035***	0.039***	0.007***
	[0.007]	[0.007]	[0.007]	[0.001]
Y2002	0.046***	0.042***	0.048***	0.009***
	[0.007]	[0.007]	[0.007]	[0.001]
Extr. nat. resource	0.009	0.003	0.006	-0.001
	[0.036]	[0.04]	[0.038]	[0.005]
Food products	-0.026	-0.044*	-0.042*	-0.003
	[0.025]	[0.026]	[0.026]	[0.004]
Tobacco	0.179***	0.16***	0.172***	0.049*
	[0.026]	[0.026]	[0.026]	[0.025]
Textiles	-0.063**	-0.084***	-0.077***	-0.009**
	[0.03]	[0.031]	[0.031]	[0.004]
Clothing & furs	-0.023	-0.046	-0.034	-0.003
	[0.043]	[0.046]	[0.046]	[0.008]
Leather & shoes	0.008	-0.008	0.006	-0.005
	[0.079]	[0.081]	[0.082]	[0.012]
Wood & cork	-0.023	-0.024	-0.017	-0.016***
	[0.038]	[0.038]	[0.039]	[0.003]
Paper	-0.012	-0.039	-0.032	-0.003
	[0.034]	[0.034]	[0.034]	[0.004]
Publishing	-0.011	-0.025	-0.015	0.001
	[0.027]	[0.028]	[0.028]	[0.004]
Cokes	-0.083	-0.111*	-0.1	-0.004
	[0.059]	[0.062]	[0.063]	[0.005]
Chemicals	-0.005	-0.022	-0.018	0.005
	[0.026]	[0.027]	[0.027]	[0.004]
Rubber	-0.037	-0.058*	-0.051*	0.002
	[0.028]	[0.029]	[0.03]	[0.005]
Non-metal prod.	-0.036	-0.052*	-0.048*	-0.002
	[0.028]	[0.029]	[0.029]	[0.004]
Metals	-0.094***	-0.114***	-0.11***	-0.008
	[0.032]	[0.034]	[0.034]	[0.004]

Table 1.2: Main Regression Results, continued

	(1) Assets	(2) Employment	(3) Lags	(4) etr2
Prod. metal prod.	-0.017	-0.03	-0.026	-0.002
	[0.027]	[0.028]	[0.028]	[0.004]
Machines	-0.009	-0.028	-0.018	-0.001
	[0.027]	[0.028]	[0.028]	[0.004]
Office supplies	0.007	-0.016	-0.002	-0.003
	[0.053]	[0.053]	[0.054]	[0.006]
Elec. Machines	0.024	-0.001	0.007	0.005
	[0.033]	[0.034]	[0.034]	[0.005]
Audio & TV equip.	-0.062*	-0.089**	-0.086*	0.003
	[0.036]	[0.039]	[0.041]	[0.006]
Cars	-0.021	-0.046	-0.045	0.007
	[0.036]	[0.037]	[0.038]	[0.007]
Product. Transport	-0.049	-0.08	-0.074	-0.001
	[0.058]	[0.058]	[0.062]	[0.006]
Furniture	0.011	-0.01	-0.003	-0.003
	[0.033]	[0.034]	[0.035]	[0.005]
Recycling	-0.129***	-0.127***	-0.124***	-0.008
	[0.041]	[0.041]	[0.042]	[0.007]
Elec. gas & water	-0.065	-0.078	-0.064	-0.002
	[0.059]	[0.063]	[0.063]	[0.007]
Construction	0.057***	0.048*	0.064***	-0.006*
	[0.026]	[0.026]	[0.027]	[0.003]
Car sales	0.021	0.014	0.027	0.0001
	[0.023]	[0.024]	[0.024]	[0.003]
Hotels	-0.12***	-0.141***	-0.144***	-0.01***
	[0.029]	[0.030]	[0.029]	[0.004]
Transportation	-0.02	-0.03	-0.024	-0.008**
	[0.025]	[0.026]	[0.026]	[0.004]

Table 1.2: Main Regression Results, continued

	(1) Assets	(2) Employment	(3) Lags	(4) etr2
Telecom	-0.096**	-0.101**	-0.112***	-0.003
	[0.046]	[0.048]	[0.048]	[0.008]
IT	-0.013	-0.022	-0.014	0.004
	[0.028]	[0.029]	[0.03]	[0.005]
R&D	-0.119**	-0.141***	-0.147***	-0.015***
	[0.057]	[0.057]	[0.059]	[0.005]
Real estate	-0.039*	-0.018	-0.004	-0.007**
	[0.023]	[0.025]	[0.025]	[0.003]
Publ. admin.	-0.047*	-0.054*	-0.053*	-0.005
	[0.028]	[0.029]	[0.029]	[0.004]
Constant	0.228***	0.207***	0.176***	0.039***
	[0.028]	[0.250]	[0.025]	[0.004]
Observations	27290	25683	25656	27290
R	4.46%	4.88%	3.88%	3.82%
F-statistic	13.55	14.28	14.06	9.69
Prob>F	0.00	0.00	0.00	0.00

robust standard errors are between brackets; *= significance level at 10%, **= significance level at 5%, ***= significance level at 1%

1.8 Robustness Checks

Table 1.3 reports some robustness checks. We start in column (1) by reporting the outcome of a dynamic specification where we include the lagged value of etr1 as an additional explanatory variable on the right hand side to control for possibly autocorrelation. However, our main variables of interest namely the regional effects and the time effects remain intact. In column (2) of Table 1.3 we report the results of a censored tobit regression that takes into account that etr1 is a truncated variable[19]. Another common way to control for outliers is where we cut-off all ETR observations larger or smaller than twice the standard deviation of the mean ETR. The results of this regression are shown in column (3) of Table 1.3 but our results remain qualitatively the same. In column (4) we control for carry-forwards of losses which applies under Belgian law, by including a variable ($LOSS_{t-1}$) to capture last year's losses. However, this variable is not significant in the regression and the other results go through. The results of a fixed effect estimation is reported in column (5). Controlling for firm level fixed effects is very common in micro-econometrics. These fixed effects control for a number of unobservables at the firm level that may affect ETRs and that if not controlled for may introduce an omitted variables bias. The fixed effects estimation does not change the simple OLS results. All the firm level variables and year effects continue to hold[20]. We also experimented with a random effects model but the Hausman-test decided in favor of the fixed effects model as the most preferred specification. The variables capturing the regional tax competition in Belgium continue to be negative but the significance for Wallonia is stronger than for Brussels.

And as a final robustness check, we introduce a specification where we replace the year dummies by dummies for three distinct periods in Belgian politics. While both the periods '93-94 and '95-98 coincide with a federal coalition of Christian Democrats and Socialists, the last period '99-2002

[19]The distribution of etr1s is shown in Figure 1.2 in the Appendix. The kernel density estimates for etr1 is bimodal around 0 and 40.17%, suggesting that many companies do not pay positive taxes because they makes losses or zero profits and also that a substantial number of companies have an ETR about equal to the STR.

[20]Regional dummy variables are not possible to include with fixed effects.

coincides with a coalition of Liberal Democrats and Socialists. For each of these different governments we introduce a separate dummy (labeled Gov1, Gov2, Gov3) with a value of 1 for years in power, and zero otherwise.

The last column in Table 1.3 shows the results of this specification where we dropped the first period dummy Gov1; hence the coefficients on the two other dummies are relative to the first period in our data. Both Gov2 and Gov3 are positive and significant, with the magnitude of the Gov3 variable twice the size of the Gov2 dummy. This implies that the Effective Tax Burden has increased most under the last government, probably in anticipation of the large reduction in STR in 2002 that this same government enacted. To test whether the time effects are due to federal government policy and not to business cycle effects, we use a likelihood ratio- and an F-test. Both these tests could not reject the null hypothesis that the significant time effects are indeed due to federal policy measures[21] .

[21]We use a likelihood-ratio test and an F-test to test the null hypothesis that the coefficients of the time dummies within a government period are not significantly different from each other. The test statistic for the likelihood-ratio test equals 4.69, which is lower than the critical value at the 1% level of 15.086. The F-statistic, based on the R of the two regressions, was equal to 0.216 (critical value at the 1% level = 3.78). As a result, both tests do not reject the null hypothesis that the coefficients of the time dummies within a government period are equal to each other. This implies that our results are rather due to the government in office during these years rather than to business cycle effects.

Table 1.3: Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)
	$etr1_{t-1}$	Censored	Filter	Carry forward	Fixed effects	Gov.
etr_{t-1}	0.545***	-	-	-	-	-
	[0.007]					
Employment	0.008***	0.033***	0.009***	0.016***	0.022***	0.015***
	[0.001]	[0.002]	[0.002]	[0.002]	[0.003]	[0.001]
Ltleverage	-0.004	-0.016***	-0.002***	-0.008**	-0.002	-0.008***
	[0.003]	[0.003]	[0.001]	[0.004]	[0.002]	[0.003]
Capital intens	-0.025*	-0.083***	-0.043*	-0.047*	-0.01*	-0.047*
	[0.015]	[0.006]	[0.024]	[0.028]	[0.005]	[0.027]
R&D intens	-0.145***	-0.451***	-0.27***	-0.254***	-0.118***	-0.25***
	[0.022]	[0.03]	[0.028]	[0.036]	[0.028]	[0.036]
Coord. center	-0.074***	-0.11***	-0.115***	-0.148***	-	-0.147***
	[0.015]	[0.025]	[0.021]	[0.027]		[0.027]
$Loss_{t-1}$	-	-	-	-0.001	-	-
				[0.005]		
Brussels	-0.003	-0.011*	-0.02***	-0.004	-	-0.003
	[0.005]	[0.06]	[0.007]	[0.008]		[0.008]
Wallonia	-0.007*	-0.025***	-0.014*	-0.016**	-	-0.015***
	[0.004]	[0.006]	[0.007]	[0.007]	[0.007]	
Y1994	0.035***	0.026***	0.016***	0.016***	0.021***	-
	[0.007]	[0.011]	[0.005]	[0.006]	[0.006]	
Y1995	0.027***	0.024**	0.021***	0.015***	0.016***	-
	[0.007]	[0.011]	[0.005]	[0.006]	[0.006]	
Y1996	0.032***	0.032***	0.028***	0.02***	0.023***	-
	[0.007]	[0.011]	[0.006]	[0.006]	[0.006]	
Y1997	0.031***	0.036***	0.028***	0.023***	0.024***	-
	[0.01]	[0.006]	[0.007]	[0.006]	[0.007]	
Y1998	0.033***	0.046***	0.040***	0.028***	0.022***	-
	[0.010]	[0.010]	[0.006]	[0.007]	[0.005]	
Y1999	0.042***	0.058***	0.042***	0.036***	0.025***	-
	[0.007]	[0.010]	[0.006]	[0.007]	[0.005]	

Table 1.3: Robustness Checks, continued

	(1)	(2)	(3)	(4)	(5)	(6)
	$etr1_{t-1}$	Censored	Filter	Carry forward	Fixed effects	Gov.
Y2000	0.036***	0.059***	0.042***	0.035***	0.021***	-
	[0.007]	[0.01]	[0.006]	[0.007]	[0.006]	
Y2001	0.038***	0.063***	0.042***	0.036***	0.019***	-
	[0.007]	[0.011]	[0.007]	[0.007]	[0.006]	
Y2002	0.036***	0.069***	0.042***	0.042***	0.02***	-
	[0.011]	[0.006]	[0.007]	[0.007]	[0.006]	
Gov2	-	-	-	-	-	0.013***
						[0.004]
Gov3	-	-	-	-	-	0.028***
						[0.005]
Sector-dummies	yes	yes	Yes	yes	yes	Yes
Constant	0.074***	0.074***	0.175***	0.207***	0.156***	0.215***
	[0.015]	[0.019]	[0.022]	[0.025]	[0.012]	[0.024]
Observations	25683	26477	27162	25683	25683	25683
R	33.29%	6.01%	4.74%	4.88%	0.60%	4.8%
F-statistic	174.54		13.69	14.00	9.28	16.14

robust standard errors are between brackets; *= significance level at 10%, **= significance level at 5%, ***= significance level at 1%

1.9 Conclusion

This paper is the first to investigate the determinants of Effective Tax Rates (ETRs) for Belgium using company level data for large firms for the period 1993-2002. We found evidence of regional tax competition between the Northern region and the Southern region of the country, with lower average Effective Tax Rates (ETR) in the peripheral region Wallonia compared to the more 'core' region Flanders. In addition, our findings indicate that Effective Tax Rates for large Belgian companies have steadily increased over the period 1993-2002. Especially at the end of the nineties, when a new government took office, the average effective tax rate rose substantially. One possible explanation for this is that this government anticipated the strong reduction in STR it enacted in December 2002. By widening the tax base in the years just before that reduction, the effect on the country's budget is at least partly offset and the impact on the budget dampened. Hence, our results of increasing ETRs, may pick up an anticipatory effect of the decrease in the STR in 2002.

Our data consisted of large Belgian firms all subject to the highest statutory tax rate (STR) of 40.17%. However, the average Effective Tax Rates (ETR) which takes into account the tax base, lies substantially below that and for the more than 12,000 firms in our sample averages around 26%. Moreover, ETRs differ substantially between firms, sectors and regions. Labor intensive firms pay relatively more taxes than capital intensive firms. Also, capital structure and R&D-intensity strongly affect the effective tax rate. In terms of sectoral differences, we find 'socially desirable sectors' such as tourism, recycling and R&D to pay relatively lower taxes than less socially desirable sectors such as for instance the 'Tobacco' sector. Based on the findings in this paper we can conclude that Belgian corporate taxation is not neutral with respect to firm size, the source of financing and geographic location.

1.10 Appendix

Table 1.4: Sectors, 2-digit level of Nace-Bel code

Sector	Nace-Bel code	Obs Flanders	Obs Wallonia
extraction of natural resources	10,11,12,13,14	647	376
food products	15	2822	680
Tobacco	16	80	10
Textiles	17	1461	186
clothing and furs	18	355	7
leather and shoes	19	17	10
wood and cork	20	499	162
Paper	21	551	149
Publishing	22	861	466
Cokes	23	87	28
Chemicals	24	1484	632
Rubber	25	1137	246
non-metal minerals	26	1477	586
Metals	27	423	382
production of metal products	28	2054	533
Machines	29	1440	477
office supplies	30	124	10
electrical machines	31	604	163
audio and television equipment	32	259	81
optical and clocks	33	177	87
Cars	34	481	81
production of transport means	35	122	59

Sector	Nace-Bel code	Obs Flanders	Obs Wallonia
Furniture	36	1048	106
Recycling	37	236	118
Utilities	40,41	52	30
Construction	45	3697	1279
car sales	50,51,52	19445	4738
Hotels	55	463	102
Transportation	60,61,62,63	5726	732
Telecom	64	59	14
IT	65,66,67,72	894	243
R&D	73	47	18
real estate activities	70,71,74	8521	2059
public administration	75,85,90,91,92,93,99	1015	431

Table 1.5: Correlation Matrix

	etr1	etr2	total assets	employ-ment	LT leverage	capital intens	R&D intens	coord. center	Brussels
Wallonia	-0.03	-0.03	-0.03	0.01	-0.003	0.05	-0.01	-0.02	-0.27
Brussels	-0.02	0.002	0.04	-0.02	0.003	-0.05	0.08	0.04	1
coord. center	-0.05	-0.04	0.16	-0.02	-0.002	-0.04	-0.03	1	0.04
R&D intens	-0.08	-0.04	-0.1	-0.07	0.02	-0.05	1	-0.03	0.08
capital intens	-0.1	-0.08	-0.001	0.01	0.06	1	-0.05	-0.04	-0.05
LTleverage	-0.04	-0.02	-0.02	-0.03	1	0.06	0.02	-0.002	0.003
employment	0.08	0.02	0.65	1	-0.03	0.01	-0.07	-0.02	-0.02
total assets	-0.02	-0.1	1	0.65	-0.02	-0.001	-0.1	0.16	0.04
etr2	0.45	1	-0.02	0.02	0.02	-0.08	-0.04	-0.04	0.002

Table 1.6: Data-Appendix

etr1	Corporate tax expenses/ profit before taxes
etr2	Corporate tax expenses/ total assets
Brussels	=1 if in Brussels, =0 otherwise
Wallonia	=1 if in Wallonia, =0 otherwise
total assets	log(total assets)
employment	log(employment)
capital intens	tangible fixed assets/ total assets
LTleverage	total LT debt/ total assets
R&D intens	Intangible fixed assets/ total assets
coord. center	=1 if coordination center (Nace-Bel=74152), =0 otherwise
sectors	33 sector dummies at 2- digits Nace-Bel (=0 if optical and clocks sector)
Y1994 - Y2002	9 Year dummies (=0 if 1993)

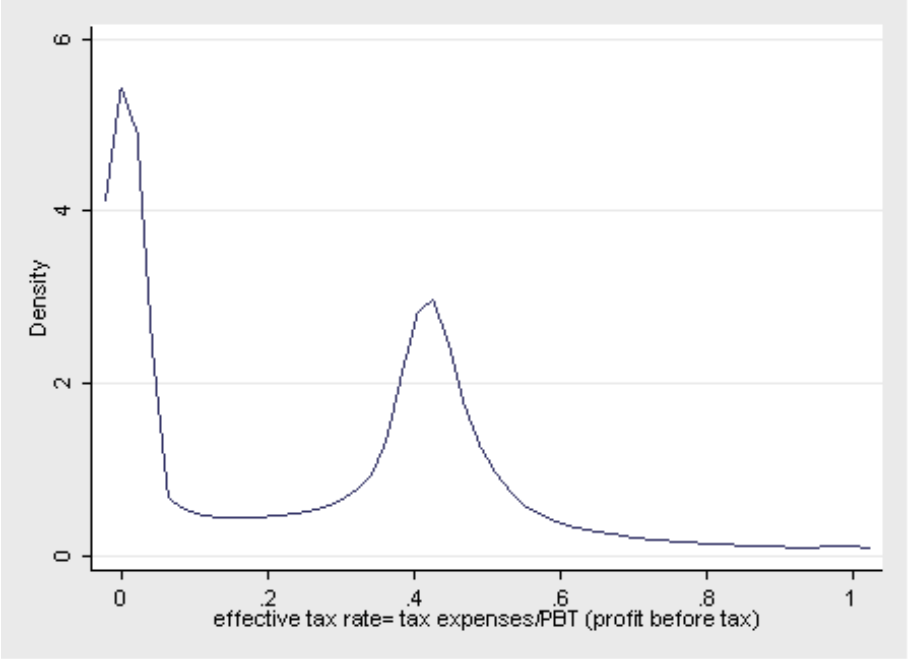

Figure 1.2: Kernel Density Estimates of ETR

Chapter 2

Strategic Corporate Tax Competition in Italy

2.1 Introduction

Italy is a typical example of a European country with large regional differences. The regions in the center-north have high levels of development and low unemployment rates (around 6%), while the Mezzogiorno (the south and the islands) has high unemployment rates around 21% up to 50% in some areas in 2002. These differences is what we call a core-periphery structure. The regions in the center-north are the 'core', while the south, the islands and some mountain regions in the north are the 'periphery'. To solve this unemployment problem, the Italian government provides incentives such as tax credits on new investments (until 2006) and loans at low interest rates to attract new industrial companies to southern Italy and certain depressed mountain regions in northern Italy. But also other differences in tax incentives and variety in enforcement amongst regions will result in regional differences of the effective tax rate (ETR).

This chapter will analyze regional differences in the effective tax rate of Italian companies and investigate whether regions strategically compete over effective tax rates to attract capital to their jurisdiction. On the one hand, core regions can set a higher tax rate in comparison to peripheral regions, because firms in the core benefit from a well developed infrastructure and

agglomeration spillovers (Baldwin & Krugman 2004). On the other hand, when the tax gap between core and periphery becomes too large, firms will consider moving to the periphery. Therefore, the core is also limited in its tax setting. Taking into account firm and sector characteristics, results show that companies in southern and mountain regions Basilicata, Campania, Sicilia, Sardegna, Abruzzo, Lazio and Valle D'Aosta have a significant lower effective tax rate than the overall average effective tax rate of 47.8 percent. The main goal of this chapter to study wether these regional tax differences are a result of strategic behavior of the Italian regions. In the literature the method to test for strategic interaction amongst regions is a fiscal reaction function. If regions set their tax rates interdependent, the fiscal reaction function will have a nonzero slope. This chapter will use different measures of neighbors and in addition will analyze the strategic behavior in tax setting between the core and periphery regions.

The results indicate that for every definition of neighbors, Italian regions react to changes in the effective tax rate of neighboring regions. In addition, strategic interaction between Italian regions over the local statutory tax rate IRAP is examined. The IRAP is a local tax on value added business activities which can be set more or less independently by the regions since 2001. The results show that if a periphery region decreases its IRAP tax rate, core regions will react by also decreasing their tax rate in order not to widen the gap in tax rates too much and vice versa. To conclude, Italian regions compete over ETR and IRAP to attract firms to their jurisdiction.

The structure of the chapter is as follows. Section 2.2 gives an overview of the Italian corporate tax system and reforms during the period 1993-2006. The literature on fiscal strategic interactions and how to measure effective tax rates is summarized section 2.3. Section 2.4 reports the collection of the data and the descriptive results. Section 2.5 shows the firm level model and results, while section 2.6 shows the strategic interaction model and results. Finally, section 2.7 concludes.

2.2 Italian Corporate Tax System

The Italian corporate tax system has known a considerable number of reforms. Table 2.1 gives a summary of all tax rates and tax incentives for the period 1993-2006. Before 1998, Italian companies were subject to the corporate tax rates IRPEG ('imposta sul reddito delle persone giuridiche') and ILOR ('imposta locale sul reddito'). IRPEG is the usual corporate income tax. The tax base for IRPEG is the company's profit adjusted for depreciation allowances[1], carry-forward losses[2], interest payments and dividends[3]. The flat tax rate ILOR of 16.2 percent is applied to profits with no carried-forward losses and no dividends included in the tax base. These two taxes lead to an overall statutory tax rate (STR) of 52.2% in 1993. On top of this STR, Italian companies have to pay an additional tax of 0.75 percent on their net assets[4]. This extra tax was abolished in 1998.

The IRPEG rate changed in 1995, 2001, 2003 and 2004, but the largest reform was in 1998 which was designed to achieve more neutrality in the tax system. First, the ILOR tax was replaced by IRAP, a local tax on added value generated by all business activities. Since 2001, the regions are allowed to differentiate this IRAP upwards and downwards by up to 1 percent and differentiate between sectors and activities. Secondly, a dual income tax system, DIT, was introduced. This system divides profits into two components. The nominal profits, i.e. net equity formed by capital and reserves, are taxed at a reduced rate of 19 percent. The extra-profit is taxed at the normal statutory rate, IRPEG. DIT was supposed to stimulate equity

[1]Firms are able to benefit from increased depreciation allowances for capital investments in the first 3 years of the investment.

[2]Losses can be carried-forward for up to 5 years.

[3]Before 1992, receiving dividends from resident companies are entitled to a tax credit of 56.25 percent, while nonresident companies may not benefit this tax credit except for the UK and France. Since 1992, a European directive allows dividends from an Italian or a European associated company (engaged to hold at least 25 percent for more than 12 months) to be exempted from the taxable income for 95 percent. Since 2002, the 95 percent exemption is extended to non-EU companies resident in countries or territories characterized by a level of taxation similar to that in Italy and with which Italy has a system for exchange of information.

[4]Net worth is the value of total assets minus the value of total liabilities or in other words the net assets.

opposed to debt financing.

In order to attract new industrial enterprises to southern Italy and certain depressed mountain regions in central and northern Italy[5], capital investments in these areas benefit from tax credits and more beneficial loans until December 2006. Furthermore, in Southern Italy manufacturing companies established between March 29, 1986 and December 31, 1993 do not pay IRPEG taxes for 10 years since their incorporation and they do not pay ILOR taxes for 10 years from the first year in which the company makes profit. In addition to these general tax incentives, the Tremonti tax credit was introduced in 1994 to stimulate the economy. If a company invests more than its average investment in the previous five years, a tax credit up to 50 percent of the investment is granted. The Tremonti tax credit could be carried forward up to 5 years. According to Bernasconi et al. (2005), investment increased by 20 percent during the period 1994-1996 and to fulfill the condition of the credit, more than 60 percent of Italian companies realized investments greater than their average of the previous 5 years. One reason of the success is probably the short period during which the credits were allowed. In 1999 the Visco investment credit for equity-financed investment was introduced. This tax credit was allowed until 2002. During the last two years, companies could choose between the Visco investment credit or the new Tremonti tax credit[6]((Bernasconi et al. 2005), (Staderini 2001), (pricewaterhousecoopers 2002)).

In 2005, the advocate general of the European court of justice concluded that the IRAP is prohibited by the sixth VAT directive which prohibits EU member states from introducing or maintaining VAT-like systems of taxation not to interrupt the proper functioning of VAT. Since it can not be expected that Italy would change its tax system of regional financing overnight, it was suggested that the judgement will take effect at the end of the tax period 2006. In order to meet the European rules, the 2004 reform of the Italian tax system decided to repeal IRAP over 3 years and substitute by more expense deductions such as tax incentives for R&D costs (pricewaterhousecoopers 2002).

[5]Basilicata, Calabria, Campania, Puglia, Sardegna, Sicilia, Abruzzo and Molise

[6]This new Tremonti tax credit is the same as the Tremonti law in 1994.

Table 2.1: Summary Table, in percent

Year	IRPEG	ILOR	DIT	IRAP	Tax on net worth	Tax incentives	STR
1993	36	16.2			0.75		52.2
1994	36	16.2			0.75	Tremonti	52.2
1995	37	16.2			0.75	Tremonti	53.2
1996	37	16.2			0.75	Tremonti	53.2
1997	37	16.2	19		0.75		53.2
1998	37		19	4.25			41.25
1999	37		19	4.25		Visco & DIT	41.25
2000	37		19	4.25		Visco & DIT	41.25
2001	36			4.25[a]		Visco & DIT or new Tremonti	40.25
2002	36			4.25[a]		Visco & DIT or new Tremonti	40.25
2003	34			4.25[a]		tax incentives for R&D costs limitations on interest deduction	38.25
2004	33			4.25[a]		tax incentives for R&D costs limitations on interest deduction	37.25
2005	33			4.25[a]		tax incentives for R&D costs limitations on interest deduction	37.25
2006	33			4.25[a]		tax incentives for R&D costs limitations on interest deduction	37.25

note: a = regions can differentiate this rate upwards or downwards by up to 1 percentage and can differentiate the rate by categories of taxpayers, sector or activity (Bernasconi et al. 2005)

To summarize, the main regional tax differences come from 2 legal tax incentives. First, tax incentives are given to new investments and manufacturing companies in less developed regions of Italy. Second, the local IRAP tax rate can directly be manipulated by the regions.

2.3 Tax Competition Literature

Fiscal interaction amongst governments is studied already a long time. Fiscal interaction may occur as a result of benefit spillovers, where residents consume the public goods provided by neighboring jurisdictions or it can be a result of capital mobility. With capital mobility, tax rates in other jurisdictions must be taken into account which leads to strategic behavior. This strategic behavior is studied in the empirical literature as strategic interaction models or fiscal reaction functions[7]. This section first introduces the classic strategic interaction model and second summarizes the empirical literature on this matter.

2.3.1 Strategic interaction model

In a tax competition model, jurisdictions are affected by the amount of a particular resource within their borders for example a mobile tax base (Brueckner 2003). Brueckner (2003) summarizes the tax competition, resource-flow model as follows:

Assume that jurisdictions produce a private good using mobile capital and immobile labor. In the model, $f(k_i)$ is the production function and k_i is the capital per worker in jurisdiction i. The capital per worker will act as the resource variable. Furthermore, jurisdictions have identical population sizes and tax locally employed capital at a rate t_i. A public good is provided and financed by tax revenue per worker, $t_i k_i$. To equalize net-of-tax returns, capital moves across jurisdictions so that

[7]The terms fiscal reaction function, tax mimicking, spatial competition and strategic interaction will be used as synonyms explaining the strategic behavior amongst regions as a reaction to tax rate changes in related other regions

$$\begin{aligned} f'(k_j) - t_j = \rho; j = 1, ..., n \\ \sum_{j=1} k_j = n\overline{k} \end{aligned} \tag{2.1}$$

with ρ as the net return of capital and $\overline{k}$ the economy-wide level of capital per worker. Rewriting ρ and k_i in terms of tax rates gives

$$\begin{aligned} k_i = H(t_i, t_{-i}) \\ \rho = G(t) \end{aligned} \tag{2.2}$$

These equations indicate that capital will move to jurisdiction i if it has the most beneficial tax rate, t_i, compared to the tax rate in other jurisdictions, t_{-i}. Moreover, net return of capital depends on all tax rates.

Finally, individual consumption, c_i, is equal to the sum of the wage, $w(k_i)$, and the income from ownership of capital under the assumption that consumers own equal shares of the total, $\rho\overline{k}$. Using this information, the preferences of the jurisdictions can be written as:

$$\begin{aligned} U(c_i, q_i; \widetilde{X_i}) = U[w(k_i) + \rho\overline{k}, t_i k_i; \widetilde{X_i}] \\ = U[w(H[t_{i,t_{-i}}]) + G(t)\overline{k}, t_i H[t_i, t_{-i}]; \widetilde{X_i}] \\ \equiv V(t_i, t_{-i}; \widetilde{X_i}) \end{aligned} \tag{2.3}$$

where $\widetilde{X_i}$ are characteristics of jurisdiction i. Maximizing (2.3) by choice of t_i yields the fiscal reaction function

$$t_i = R(t_{-i}, \widetilde{X_i}) \tag{2.4}$$

Equation (2.4) implies that in choosing t_i, jurisdiction i will take into account that an increase in the tax rate will cause capital flees and lowers capital's net return ρ. Moreover, this impact will depend on the tax rates in the other jurisdictions (Brueckner 2003). Summarized, a fiscal reaction function essentially measures whether a jurisdiction will change its tax rate in response to changes in the tax rate of other jurisdictions. When tax rates are chosen strategically, the reaction function has a nonzero slope.

2.3.2 Empirical Literature on Strategic Interaction

Strategic interaction amongst regions within one country is mostly studied for local property tax rates (for example Bordignon et al. (2002), Heyndels & Vuchelen (1998), Brueckner (1998), Brett & Pinkse (2000), Brueckner & Saavedra (2001), Buettner (2001), Allers & Elhorst (2005) and Ollé (2003)) and expenditures (for example Revelli (2003), Case et al. (1993), Geys (2006), Baicker (2005) and Werck et al. (2007)). Besley & Case (1995) study local corporate taxes for US states during the period 1960-1988. They find that local tax-setting in the states is tied because of yardstick competition. This means that voters use information from other jurisdictions to judge the performance of their own politicians. Therefore, rational politicians will mimic their neighbors' tax rates to secure their re-election. Bordignon et al. (2002) show for Italian cities that mayors who ran for reelection in 2000 mimicked property tax rates of adjacent cities[8].

This chapter will extend this literature by studying strategic interaction of corporate taxes amongst Italian regions using a panel of ten years.

2.3.3 Effective Tax Rates

Effective tax rates (ETR) can be computed in 3 various ways: macro-backward looking, micro-backward looking and micro-forward looking method. The main differences between these measures is the level of aggregation (micro or macro data) and the type of information used (backward- or forward-looking). The macro-backward looking method computes effective tax rates on an aggregated country-level with data from national accounts. This method defines the ETR as the ratio of tax revenue to a country's gross operating surplus (Gorter & de Mooij (2001), Mendoza et al. (1994), Martinez-Mongay (1997), Volkerink & de Haan (2000) and Stewart & Webb (2006)). Since the numerator includes profits from tax-exempted rents, royalties and revenues from capital assets, this method usually understates the real effective tax burden of a country. Secondly, it is not possible to analyze firm- sector- or regional heterogeneity in ETRs (Nicodème 2001).

[8]For an exhaustive overview of the empirical literature in strategic interaction studies see Brueckner (2003).

Micro-level ETRs differ in the type of information used. Backward-looking studies use real-life data from financial statements, while forward-looking studies use information of the legal tax system. Therefore forward-looking studies are considered for investigating a hypothetical investment decision given a particular tax structure and financial assumptions (Devereux et al. 2002). The drawback of this theoretical measure is that it does not take into account the complexity and the interaction of all elements of the tax system such as carry-forwards and tax incentives. As a consequence the micro-backward looking method is more suited for the type of research question analyzed in this chapter. This method computes the ETR using two elements from the company's profit and loss account.

$$\begin{aligned} ETR_{it} &= corporate\ taxes\ paid_{it}/profit\ before\ tax_{it} \\ corporate\ taxes\ paid_{it} &= STR_{it}\ * tax\ base_{it} \end{aligned} \tag{2.5}$$

where i is a particular firm in year t. Since the numerator is based on the tax base and the denominator is the gross profit before tax, this measure captures the effective tax burden of a firm. The difference between a firm's ETR and the overall STR reflects the amount of tax incentives for the firm [9].

Since the IRAP, one of the tax rate part of the overall corporate tax rate, is applied to the value added of business activities instead of profits, a second ETR measure is considered.

$$ETR2_{it} = corporate\ taxes_{it}/value\ added_{it} \tag{2.6}$$

2.4 Data

2.4.1 Data Selection

The research question in this chapter is twofold. Therefore, two different datasets are collected. First, to investigate whether there exist regional differences in the ETRs of Italian firms, data from financial statements is collected from Dijck (2005). The database Dijck (2005) includes financial

[9] A complete discussion of ETR measures is described in Devereux et al. (2002) and Nicodème (2001).

statements of 5.5 million firms from 38 European countries. Firms are selected amongst the 250 000 largest Italian firms in Dijck (2005)[10]. Only non-financial firms were selected, since financial firms apply different accounting standards and only data from unconsolidated active[11] companies is collected for the period 1993-2003. This selection process sets up a dataset of 14 938 firms. Finally, extreme observations with $ETR < 0$ and $ETR > 1$ were excluded (Collins & Shackelford (2003) and Vandenbussche et al. (2005)).

A second step analyzes whether these regional differences are a result of strategic behavior of the regions. Therefore a second dataset is constructed. This dataset consists of the average effective tax rate for every region, regional population and GDP data from the national institute of statistics, which were available for 1990-2006. The individual IRAP tax rates were available for every region from the Italian ministry of finance for the period 2002-2006.

2.4.2 Descriptive Results

The characteristics of the two datasets are summarized in Table 2.2. The table shows that the average Italian ETR for the period 1993-2003 is 47.8%. The firms are on average 28 years old an only a few observations are quoted on the stock market. The average number of employees and profit before tax of the firms indicate that the sample exists of very large firms. Furthermore, 27% of the firms are owned by foreign shareholders[12] and 4.24% of the firms holds at least 50% of the shares of a foreign company.

Figure 2.1 illustrates the evolution of the average ETR over the period 1993-2003. The average ETR for large Italian firms strongly increases from 1995 onwards until 1998. After the tax reform of 1998 the ETR decreases, but stays around 50%. The average ETR of 2003 increases again above 50%. The increasing trend during the early '90s in effective tax rates is a common trend in the European Union. European countries carried through

[10]The selection criteria in Amadeus for the top 250 000 companies in Italy are: operating revenue > 15 million euro, total assets > 30 million euro or number of employees > 150

[11]The firms with bankruptcy, dissolved, in liquidation and inactive legal status were dropped from the sample.

[12]Firms are foreign owned when more than 50% of their shares are in hands of foreign owners and foreign subsidiaries are for more than 50% of Italian firms.

Table 2.2: Descriptives on the firm-level, 1993-2003

	Average
year	1993-2003
Observations	84 922
ETR (%)	47.8
	(26.6)
Number of employees	144.33
	(1 205.29)
Firm age	28
	(15.45)
Number of quoted firms (%)	0.14
Profit before tax (th. euro)	1844.548
	(46903.16)
Foreign owned observations (%)	27.46
Foreign subsidiaries (%)	4.24
ETR2 (%)	10.08
	(26.4)
year	1993-2006
Regional GDP (in millions)	54 426.8
	(52265.25)
Regional labor force (15≤age≤65)	1 967 081
	(1 579 638)

source: Amadeus database and national institute for statistics; note: standard deviations between brackets

a combination of decreasing statutory tax rates and increasing tax rates in order to minimize the effect of a lower statutory tax rate for the tax revenues (Devereux et al. (2002) and Vandenbussche & Crabbé (2006)).

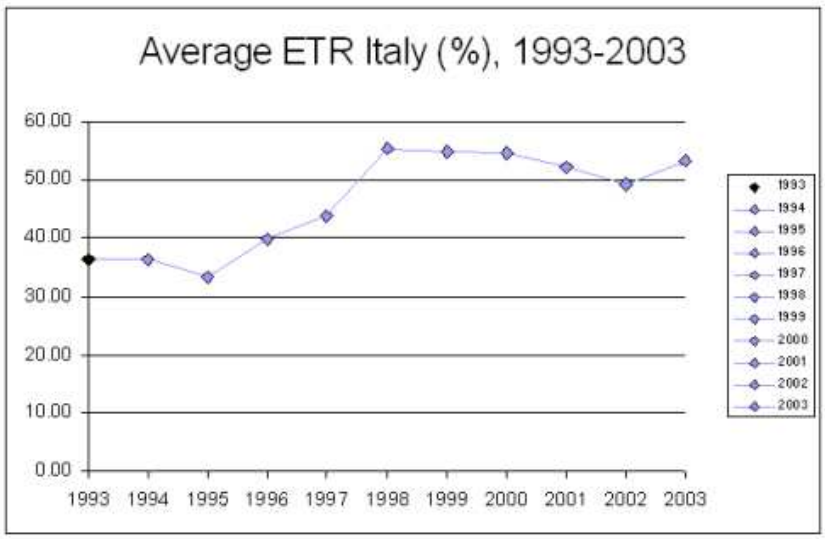

Figure 2.1: Average ETR in Italy over time

Figure 2.1 shows the average ETR per region. The figure indicates that the difference in ETR between the region with the highest average ETR (Marche, 50.5%) and the lowest average ETR (Basilicata, 32.2%) is equal to 18.3% and so substantial. Not surprising, the 10 southern and mountain area regions have the lowest average ETR, while the 10 central and northern regions have the highest average ETR. As a consequence a core-periphery structure is already reflected in the descriptive statistics. The average ETR of Umbria is almost equal to the overall average of 47.8% and will therefore be used as the reference region in section 2.5. The average effective tax rate of the core and the periphery are illustrated in Figure 2.3. Over time, the gap between the core and periphery decreased from 11% in 1993 to 5% in 2003.

Finally, Figure 2.4 presents the percentage of foreign owned firms per region. It is clear from this table that more foreign owned firms are located in the North and center of Italy (core area).

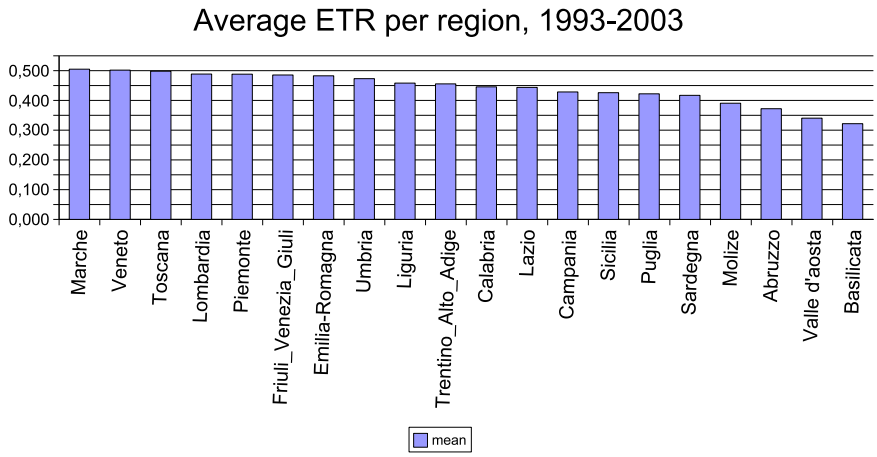

Figure 2.2: Average ETR per Italian region, 1993-2003

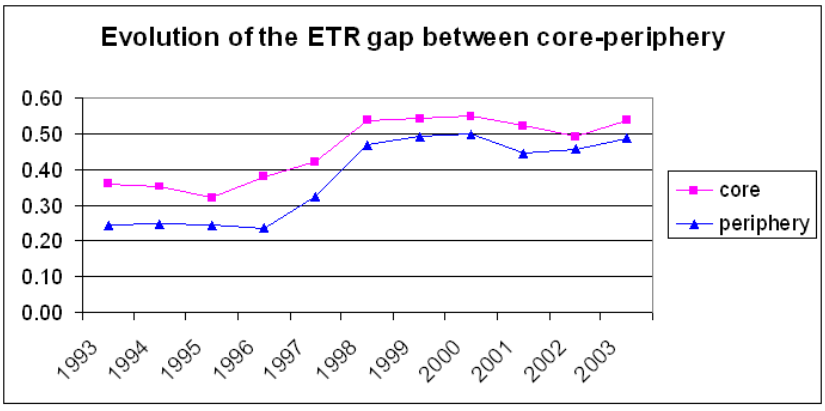

Figure 2.3: Average ETR in Italian core and periphery regions, 1993-2003

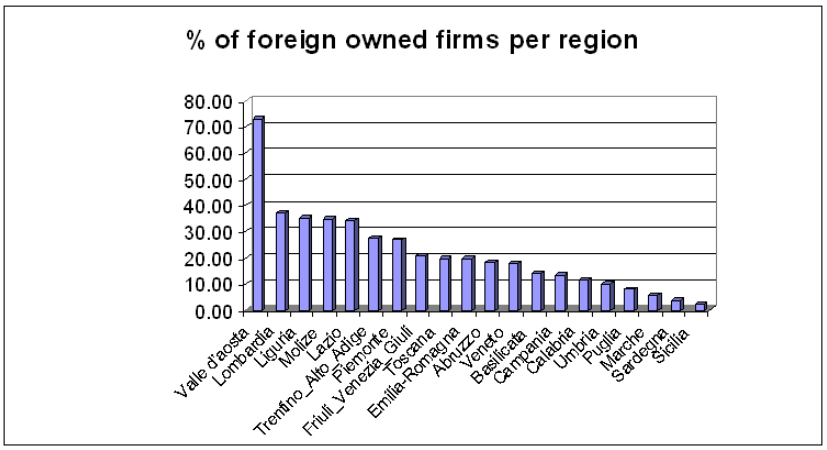

Figure 2.4: Share of foreign owned firms per Italian region

2.5 Differences in ETR across Firms

2.5.1 Model

First, the determinants of the effective tax rate of Italian firms will be identified using the following estimation model:

$$\begin{aligned} ETR_{it} &= \beta_0 + \beta_1 firm\ size_{it} + \beta_2 capital\ intensity_{it} \\ &+\beta_3 R\&D\ intensity_{it} + \beta_4 LT\ leverage_{it} + \beta_5 region_i \\ &+\beta_6 sector_i + \delta_t + \varepsilon_{it} \end{aligned} \tag{2.7}$$

where the dependent variable, ETR, is the effective tax rate of firm i in year t and δ_t are time dummies.

The specification of the model closely follows the literature by including variables that control for legal tax incentives (capital and R&D intensity, LT leverage, foreign ownership), other firm characteristics (firm size), time dummies, sector dummies and regional dummies (Buijinck et al. (2002), Buijinck et al. (2000), Nicodème (2002), Huizinga & Nicodème (2006), Gupta & Newberry (1997), Collins & Shackelford (2003), Janssen (2005), Vandenbussche et al. (2005) and Vandenbussche & Tan (2005)). The definitions of the variables are described in Table 2.10 in Appendix.

The model includes firm size measured by number of employees or total assets. The literature is not clear on the relationship between firm size and ETR. On the one hand, the 'political cost theory' argues that large firms have a higher visibility, which means they picked out more for control. As a result larger firms face higher ETRs. On the other hand, 'the political power theory' argues that larger firms have greater resources to influence the political process and therefore are expected to face lower ETRs (Gupta & Newberry 1997). Nicodème (2002), using sales as a size variable, derived a theoretical, positive relationship between a firm's sales and its tax liability, suggesting that larger firms would pay more taxes. However, empirically he found a negative relationship between size variables and tax liabilities, suggesting that larger firms pay lower taxes. The other firm-level variables in the model as capital intensity, R&D intensity, LT leverage and foreign ownership are included to control for the legal tax credits for investments, dividends and interests. As a consequence, these variables are expected to lower the ETR of the firm. Finally, the model includes dummy variables to control for time, sector and region. The year 1993, the sector agriculture, hunting and related service activities[13] and Umbria region[14] respectively are taken as a benchmark. The correlation between all variables is summarized in Table 2.3.

2.5.2 Results

The results are reported in Table 2.4. Regression (2) adds a dummy variable for foreign ownership and foreign subsidiaries, while regression (3) includes a dummy for carry forwards of losses. The regression in column (4) includes a variable for firm age.

The results indicate that the regions Basilicata, Campania, Sicilia, Valle D'Aosta, Sardegna, Abruzzo, Puglia, Calabria and Lazio have a significant lower ETR than the average ETR in all specifications in Table 2.4. These regions are southern regions or regions in mountain areas with low pop-

[13]This sector is randomly chosen as the reference sector by the statistical program STATA since regional differences are the focus of this chapter.

[14]The average ETR of Umbria over the whole period is 0.473 which is closest to the overall average ETR.

Table 2.3: Correlation matrix

	ETR	log (tot. assets)	log (employ.)	capital intens.	R&D intens.	LT lev.	ST lev.	carry forw.	foreign owner	foreign subs.
ETR	1	-0.05	0.05	-0.14	-0.07	0.045	0.07	-0.294	-0.03	-0.01
log(tot. assets)	-0.05	1	0.6	0.16	0.05	0.055	0.003	0.063	0.25	0.09
log(employ.)	0.05	0.6	1	0.17	0.07	0.038	-0.07	-0.007	0.18	0.1
capital intens.	-0.14	0.16	0.17	1	-0.04	0.066	-0.03	0.006	-0.08	-0.03
R&D intens.	-0.07	0.05	0.07	-0.04	1	-0.025	-0.06	0.094	0.07	0.03
LT leverage	0.05	0.06	0.04	0.07	-0.03	1	0.002	-0.056	-0.11	0.03
ST leverage	0.07	0.003	-0.07	-0.03	-0.06	0.002	1	0.058	-0.13	-0.004
ROA	0.13	-0.04	0.06	-0.09	-0.14	-0.007	-0.2	-0.372	0.04	0.08
Carry forw.	-0.29	0.06	-0.01	0.01	0.09	-0.056	0.06	1	0.02	-0.04
Foreign own.	-0.03	0.14	0.12	-0.03	0.04	-0.046	-0.08	0.037	1	0.01
Foreign subs.	-0.01	0.18	0.17	0.02	0.01	0.023	0.002	-0.004	0.01	1

Table 2.4: Basic regression

dep. var. = ETR	(1)	(2)	(3)	(4)
	(Basic)	(Foreign own.)	(Carry forwards)	(Firm age)
Log(employment)	0.016***	0.018***	0.0144***	.011***
	(0.001)	(0.001)	(0.001)	(.001)
LT leverage	0.327***	0.335***	0.245***	.324***
	(0.056)	(0.05)	(0.052)	(.056)
Capital intensity	-0.186***	-0.19***	-0.128***	-.188***
	(0.01)	(0.01)	(0.009)	(.010)
R&D intensity	-0.338***	-0.332***	-0.126***	-.3687***
	(0.027)	(0.027)	(0.025)	(.031)
Firm age	-	-	-	.0003***
				(.0001)
Foreign ownership	-	-0.048***	-	-
		(0.006)		
Foreign subsidiaries	-	-0.023***	-	-
		(0.007)		
Carry forward		-	-0.24***	-
			(0.005)	
Sicilia	-0.048***	-0.049***	-0.048***	-.053***
	(0.016)	(0.046)	(0.015)	(.017)
Piemonte	0.006	-0.007	-0.003	.007
	(0.013)	(0.013)	(0.012)	(.013)
Marche	0.01	-0.01	-0.005	.009
	(0.014)	(0.014)	(0.014)	(.015)
Valle D'Aosta	-0.122***	-0.113***	-0.068	-.138***
	(0.052)	(0.053)	(0.044)	(.051)
Toscana	0.01	-0.01	0.003	.008
	(0.013)	(0.013)	(0.012)	(.014)
Campania	-0.053***	-0.053***	-0.053***	-.051***
	(0.014)	(0.014)	(0.013)	(.014)
Puglia	-0.047***	-0.047***	-0.043	-.036**
	(0.017)	(0.017)	(0.016)	(.018)

dep. var. = ETR	(1)	(2)	(3)	(4)
Veneto	0.014	-0.014	0.006	.014
	(0.012)	(0.012)	(0.011)	(.013)
Lombardia	-0.0003	-0.002	-0.001	.002
	(0.012)	(0.012)	(0.011)	(.012)
Emilia-Romagna	-0.006	-0.005	-0.01	-.005
	(0.012)	(0.012)	(0.011)	(.013)
Trenito-Alto Adige	-0.024*	-0.023	-0.039**	-.026*
	(0.015)	(0.014)	(0.018)	(.015)
Sardegna	-0.054***	-0.054***	-0.054	-.043**
	(0.02)	(0.02)	(0.037)	(.021)
Molise	-0.072*	0.071*	-0.031	-.091**
	(0.038)	(0.039)	(0.022)	(.042)
Calabria	-0.047**	-0.048**	-0.103	-.038
	(0.023)	(0.023)	(0.017)	(.025)
Abruzzo	-0.101***	-0.1***	-0.103***	-.101***
	(0.018)	(0.018)	(0.017)	(.019)
Lazio	-0.038***	-0.035***	-0.028**	-.036***
	(0.014)	(0.014)	(0.013)	(.014)
Friuli-Venezia Giuli	0.003	0.004	-0.005	.003
	(0.015)	(0.015)	(0.014)	(.015)
Liguria	-0.017	-0.015	-0.013	-.012
	(0.016)	(0.016)	(0.015)	(.017)
Basilicata	-0.145***	-0.145***	-0.153***	-.166***
	(0.025)	(0.025)	(0.026)	(.025)
Year dummies	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes
constant	0.237***	0.233***	0.29***	.243***
	(0.024)	(0.024)	(0.024)	(.026)
Observations	72 528	72 535	60 836	67 112
R^2	0.135	0.137	0.189	0.139

note: Robust standard errors of estimates are in parentheses. All regressions are clustered for firm observations. Regression (2) controls for foreign ownership and foreign subsidiaries, while regression (3) controls for carried forward losses in the tax base. The age of the firms is added as a control variable in regression (4). ***, ** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

ulation densities and employment. Therefore these regions are identified as the more peripheral regions of Italy. This implies that the geographical core-periphery situation of Italy is reflected in the ETRs of the firms as Vandenbussche et al. (2005) also found for Belgium. Furthermore, larger firms in terms of employment and firms with relatively more long-term leverage have a higher ETR. While firms with relatively more capital and R&D intensity have a lower tax burden as predicted by the legal tax incentives. Foreign firms or firms with foreign subsidiaries benefit from siginificant lower taxes as in Huizinga & Nicodème (2006) and Vandenbussche & Tan (2005), while the other results stay robust. Regression (3) confirms that carry forward losses lowers the ETR of a firm, but including this variable does not change the previous results. Surprising is that the coefficient of firm age in column (4) is small but positive and very significant, indicating that older firms pay more taxes, although there exist tax incentives for older firms in Italy.

Table 2.5 shows some robustness checks for these results. First, the ambiguous sign for firm size in the literature is tested. In column (1), the logarithm of employment is substituted by the logarithm of total assets. The estimation indicates that large firms in terms of total assets have a lower ETR which is opposite to the result of employment. A possible explanation is that total assets also include investments which benefit from tax credits. Second, regression (2) shows that firms with not only relatively more long-term but also short-term leverage have a higher ETR. A possible reason for this could be that in Italy more profitable firms have easier access to loans. In regression (3) a control variable ROA, lagged by 1 period, is included to control for the profitability of the firm. This variable is positive and significant, but does not change any other result. Regression (4) uses the original dataset and excludes extreme values larger or smaller than 2 times the standard deviation from the mean value of ETR. Using this dataset, the significance of the variable leverage and of some regional variables are reduced. Finally, the alternative ETR measure is used as a dependent variable in column (5)[15]. In this estimation, only Umbria, Valle D'Aosta, Sardenga, Molise, Abruzzo and Calabria have a significant lower ETR. These are still

[15]Since the average ETR2 of Lazio is closest to the overall average of ETR2, this region will be used as the reference region instead of Umbria

southern and mountain area regions.

Although these estimations show that there exist differences in ETRs across Italian regions, it is not clear whether these differences are due to the diversity in tax rules, the variety in levels of enforcement, the existence of special tax regimes or strategic interaction between regions. Therefore a fiscal reaction function is estimated in section 2.6.

2.6 Strategic Interaction amongst Italian Regions

2.6.1 Model

To test strategic interaction amongst Italian regions, a fiscal reaction function is built as in Brueckner (2003).

$$ETR_{it} = \alpha_i + \delta_t + \beta_0 + \beta_1 ETR_{it-1} + \beta_2 (wETR)_{it} + \beta_3 X_{it} + \varepsilon_{it} \qquad (2.8)$$

where ETR_{it} is the average ETR of region i in year t, α_i is a region-specific effect, δ_t is a time effect and X is a set of regional control variables such as GDP and population. The variable of interest $wETR_{it}$ is the weighted average tax rate of the *other* regions and is defined as:

$$\begin{aligned} (wETR)_{it} &= \sum_{j \neq i} w_{ij} ETR_{jt} \\ \forall i : \sum_{j} w_{ij} &= 1 \end{aligned} \qquad (2.9)$$

where ETR_{jt} is the effective tax rate of the other regions in the sample and w_{ij} is the spatial weight. The most intuitive criterion for selecting neighbors is based upon geographical proximity. In its simplest form, it implies that two regions are considered neighbors if they share a border. Such a criterion is justified for two reasons. First, geographic neighbors are likely to experience similar cost shocks, so neighbors' tax rates are more informative than tax rates in far away regions. Second, information about nearby regions is likely to spread quite easily (Besley & Case 1995). These 'first-order-neighbors' imply that w_{ij} is equal to 1 if region j has a common land

Table 2.5: Robustness Checks

dep. var. = ETR	(1)	(2)	(3)	(4)	(5)
	Firm size	Leverage	ROA	Filter	Dep. var.= etr2
Log(employment)	-	0.017***	0.015***	0.013***	-0.01***
		(0.001)	(0.001)	(0.005)	(0.001)
Log(total assets)	-0.007***	-	-	-	-
	(0.001)				
LT leverage	0.377***	0.33***	0.337***	0.174	0.04*
	(0.054)	(0.056)	(0.051)	(0.234)	(0.009)
ST leverage	-	0.098***	-	-	-
		(0.009)			
Capital intensity	-0.159***	-0.186***	-0.161***	-0.29***	-0.11***
	(0.01)	(0.01)	(0.01)	(0.035)	(0.01)
R&D intensity	-0.344***	-0.333***	-0.252***	-0.564***	-0.21***
	(0.026)	(0.027)	(0.03)	(0.095)	(0.03)
ROA_{t-1}	-	-	0.001***	-	-
			(0.0002)		
Foreign ownership	-	-	-	-	0.02**
					(0.01)
Foreign subsidiaries	-	-	-	-	0.004
					(0.004)
Sicilia	-0.052***	-0.048***	-0.053***	-0.085	-0.006
	(0.016)	(0.016)	(0.016)	(0.065)	(0.01)
Piemonte	0.011	0.006	9.88e-06	-0.021	0.002
	(0.012)	(0.012)	(0.013)	(0.053)	(0.01)
Marche	0.011	0.01	-0.001	-0.012	0.003
	(0.014)	(0.014)	(0.015)	(0.061)	(0.01)
Umbria	-	-	-	-	-0.01*
					(0.01)
Valle D'Aosta	-0.103*	-0.119**	-0.121***	-0.224**	-0.03**
	(0.053)	(0.052)	(0.057)	(0.109)	(0.01)
Toscana	0.008	0.006	0.005	-0.059	0.003
	(0.013)	(0.013)	(0.013)	(0.054)	(0.01)

Table 2.5

dep. var. = ETR	(1)	(2)	(3)	(4)	(5)
Campania	-0.057***	-0.051***	-0.056***	-0.042	-0.02
	(0.014)	(0.014)	(0.014)	(0.057)	(0.01)
Puglia	-0.05***	-0.046***	-0.047***	-0.132**	-0.01
	(0.017)	(0.017)	(0.018)	(0.062)	(0.01)
Veneto	0.014	0.012	0.009	-0.008	0.004
	(0.012)	(0.012)	(0.012)	(0.052)	(0.01)
Lombardia	0.003	-0.001	-0.004	-0.059	0.004
	(0.012)	(0.012)	(0.012)	(0.05)	(0.01)
Emilia-Romagna	-0.004	-0.007	-0.01	-0.037	-0.003
	(0.012)	(0.012)	(0.012)	(0.051)	(0.01)
Trenito-Alto Adige	-0.022	-0.024*	-0.036***	-0.119**	0.005
	(0.014)	(0.014)	(0.015)	(0.058)	(0.01)
Sardegna	-0.062***	-0.053***	-0.058***	-0.045	-0.02*
	(0.02)	(0.02)	(0.021)	(0.077)	(0.01)
Molise	-0.077*	-0.074*	-0.069*	-0.296**	-0.03***
	(0.039)	(0.038)	(0.039)	(0.101)	(0.01)
Calabria	-0.051***	-0.049**	-0.041*	-0.057	-0.03***
	(0.023)	(0.023)	(0.025)	(0.094)	(0.01)
Abruzzo	-0.1***	-0.102***	-0.106***	-0.117*	-0.02**
	(0.018)	(0.018)	(0.018)	(0.065)	(0.01)
Lazio	-0.038***	-0.037***	-0.037***	-0.051	-
	(0.013)	(0.013)	(0.014)	(0.054)	
Friuli-Venezia Giuli	0.007	0.002	-0.003	-0.056	0.002
	(0.015)	(0.015)	(0.015)	(0.061)	(0.01)
Liguria	-0.014	-0.018	-0.02	-0.126**	0.001
	(0.016)	(0.016)	(0.016)	(0.063)	(0.01)
Basilicata	-0.14***	-0.14***	-0.17***	-0.154*	-0.02
	(0.024)	(0.025)	(0.026)	(0.089)	(0.02)

Table 2.5

dep. var. = ETR	(1)	(2)	(3)	(4)	(5)
Year dummies	yes	yes	yes	yes	yes
Sector dummies	yes	yes	yes	yes	yes
constant	0.237***	0.225	0.218***	0.386***	-0.1***
	(0.024)	(0.024)	(0.026)	(0.092)	(0.01)
Observations	72 528	75 528	59 731	94 422	70 268
R^2	0.135	0.138	0.124	0.006	0.25

note: Robust standard errors of estimates are in parentheses. All regressions are clustered for firm observations and include time and sector dummies. Regression (1) uses a different measure of firm size, logarithm of total assets. Regression (2) includes short-term leverage, while (3) also controls for return on assets. Regression (4) filters the extreme values from the original dataset as 2 times the standard deviation from the mean. The dependent variable in (5) is the alternative etr measure (taxes/value added). ***, ** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

or water border with region i (contiguity) and 0 otherwise[16] A significant coefficient for this spatial variable, $wETR_{it}$, is evidence of strategic interaction in ETRs between Italian neighboring regions. While this approach seems naturally for large US states, Heyndels & Vuchelen (1998) argument that for smaller European regions a region's reference space may extend beyond its immediate neighbors. Therefore, second-order-neighbors are taken into account as well. This means that w_{ij} is equal to 1 if region j is a second neighbor of region i and 0 otherwise. In stead of measuring neighbors as a dummy variable, a third spatial weight will be defined as the inverse distance between the capital cities of the regions. Finally, spatial weights that reflect the core-periphery structure of Italy will be used. This implies that w_{ij} is equal to 1 if region j is a core region and region i is a periphery region and vice versa.

In the literature two econometric issues for this spatial regression are identified. First, the region specific effects in regression (2.8) can be corre-

[16]The neighbor of Island Sicilia is Calibria and for Sardegna the neighbors are Campania, Lazio, Liguria, Sicilia, Toscana and basilicata.

lated with the lagged dependent variable. Therefore regression (2.8) will be estimated in first differences to get rid of the region specific effects[17]. Second, since tax competition models predict that tax rates are jointly determined (Brueckner 1998)[18], the variable $wETR_{it}$ can be endogenous and correlated with the error term. A possible estimation method to solve these 2 issues is an instrumental variable regression (Brett & Pinkse (2000), Heyndels & Vuchelen (1998), Figlio et al. (1999), Ollé (2003) and Geys (2006)).In a first stage regression the instrumented variable is derived from regressing each region i's neighbor tax rate $\sum_{i \neq j} w_{ij} ETR_{jt}$ on $\sum_{i \neq j} w_{ij} X_{i \neq j}$ and X_i. The fitted values, $\sum_{i \neq j} \widehat{w_{ij} ETR_{jt}}$ are then used as instruments for the weighted tax rates in equation (2.8). This 2SLS method is used very often in strategic interaction models (Brueckner (2003), Altshuler & Goodspeed (2002), Redoano (2003), Heyndels & Vuchelen (1998), Brett & Pinkse (2000), Carlsen et al. (2005), Ollé (2003), Figlio et al. (1999), Revelli (2002), Ladd (1992), Buettner (2003), Geys (2006), Baicker (2005), Werck et al. (2007) and Allers & Elhorst (2005)).

2.6.2 ETR Results

Table 2.6 reports the results of regression (2.8) in first differences with different spatial weights. The first column uses the first-order-neighbors, while column (2) includes the second-order-neighbors as well. Regression (3) weights the effective tax rate of the other regions with the inverse distance between the capital cities. Column (4) indicates whether the firm belongs to the core or periphery group.

The OLS estimates show a positive and significant slope of the fiscal reaction function for all spatial weights. These results indicate that Italian regions significantly react to changes in the tax burden of neighboring regions. Moreover, taking the coefficient of the first-order-neighbors, this means that a 10% decrease in the effective tax rate of the neighbors, leads to a 95% decrease on average in the effective tax rate of region i. The slope

[17] Time dummies are also not included anymore, since the variables are in first differences and the regressions already control for GDP fluctuations.

[18] By setting its tax rate, a country or region will take into account the tax rate of other countries or regions.

Table 2.6: Fiscal reaction function OLS results

dep. var. = ETR	(1) FON	(2) SON	(3) dist.	(4) core-periph.
$ETR_{i,t-1}$	0.07	0.1**	0.08*	0.11*
	(0.05)	(0.05)	(0.05)	(0.06)
$(wETR)_{i,t}$	**0.95*** **	**0.93*** **	**0.95*** **	**0.88*** **
	(0.06)	(0.06)	(0.06)	(0.09)
Population (15-65)	-2.53E-09	-2.41E-09	-4.49E-09***	-2.32E-09
	(4.96E-09)	(5.07E-09)	(5.00E-09)	(6.17E-09)
GDP	-1.13E-06***	-1.13E-06***	-1.61E-06***	-1.24E-06
	(7.22E-07)	(7.38E-07)	(7.22E-07)	(8.97E-07)
constant	0.002	0.002	0.002	0.001
	(0.003)	(0.003)	(0.003)	(0.003)
Observations	180	180	180	180
first order ser. corr. test	0.01	0.006	0.00	0.00
second order ser. corr. test	0.3	0.47	0.7	0.11

note: All regressions are estimated in first differences. Regression (1) uses the ETR of other countries weighted with the first-order-neighbors (FON), while (2) uses the second-order-neighbors (SON) as well. In regression (5) $w_{ij} = 1/\text{distance}$ between the capital cities of the regions. Regression (6) includes $w_{core-periphery}ETR_{i,t-2}$ as a spatial variable where $w_{ij} = 1$ if region j is a member of the core while region i is a periphery-region and vice versa. ***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

of the reaction function using core-periphery weights is also positive and significant. According to the theory of Baldwin & Krugman (2004), firms are willing to pay a higher tax to stay in core-regions in return for the better developed infrastructure, labor market and industry in general in these regions. The periphery-regions can use tax rates as an instrument to attract firms by setting a lower tax. Therefore it is in the interest of both regions to sustain this gap in the tax rate. When periphery-regions lower their tax rate, core-regions will also lower their tax rate to prevent capital outflow. When the core sets a lower tax rate, periphery-regions will also decrease the tax rate to maintain their tax benefit. Furthermore, regional ETRs also depend on the ETR of the previous period and GDP. The estimates indicate that regions with a higher GDP have a lower effective tax rate. This is not in line with tax competition theory which claims that larger countries have a higher tax rate because the erosion of their tax base is smaller in per capita terms (Wilson 1999). The coefficient in the table is very small and therefore negligible.

To deal with the possible endogeneity of the spatial variable, this variable is instrumented in the following Table 2.7. In addition, the lagged dependent variable is instrumented by more lags. Table 2.7 shows that results are similar as the OLS estimation. Italian regions react to changes in the tax rate of neighboring regions. The result of core and periphery regions is not robust, indicating that core regions do not react significantly to effective tax rates in the periphery regions and vice versa.

2.6.3 IRAP Results

The IRAP tax rate is a local tax on the value added of business activities. Since 2001, Italian regions can change independently the rate of this tax up to 1% and set a different rate according to the sector or firm. The regional IRAP rates for the period 2002-2005 will be used in the strategic interaction model of section 2.6.1 to test whether Italian regions use this tax rate for capital tax competition. In column (1) the IRAP tax rates of the other regions is weighted with a dummy based on the first-order-neighbors, while in column (2) the spatial weight equals 1 if region j is a member of the core while region i is a periphery-region and vice versa. For both spatial

Table 2.7: Fiscal reaction function results, IV

dep. var. = ETR	(1) FON	(2) SON	(3) distance	(4) core-periph.
$ETR_{i,t-1}$	-0.03	-0.34	-0.12	0.52*
	(0.28)	(0.24)	(0.16)	(0.29)
$(wETR)_{i,t}$	1.32****	1.44***	1.33***	1.13
	(0.41)	(0.47)	(0.34)	(0.79)
Population (15-65)	7.51E-07	6.98E-07	6.92E-08	-2.13E-06
	(8.91E-07)	(8.95E-07)	(7.18E-07)	(1.31E-06)
GDP	-4.34E-12	-6.92E-12	-2.19E-12	9.95E-12*
	(4.55E-12)	(4.49E-12)	(3.40E-12)	(5.73E-12)
constant	-0.006	0.006*	-0.006*	-0.04
	(0.02)	(0.003)	(0.02)	(0.04)
Observations	100	100	100	100
Sargan test	0.69	0.64	0.44	0.52

note: All regressions are estimated in first differences, the spatial variable and the dependent variable are instrumented in a first stage regression, not reported here. Regression (1) uses the ETR of other countries weighted with the first-order-neighbors (FON), while (2) uses the second-order-neighbors (SON) as well. In regression (5) $w_{ij} = 1/\text{distance}$ between the capital cities of the regions. Regression (6) includes $w_{core-periphery}ETR_{i,t-2}$ as a spatial variable where $w_{ij} = 1$ if region j is a member of the core while region i is a periphery-region and vice versa. ***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

weights, equation (2.8) is estimated in first differences with IV. The results from Table 2.8 show only significant results for the core-periphery structure. The coefficient is positive, indicating that core regions will adjust their IRAP tax rate in response to IRAP tax changes in the periphery regions.

Table 2.8: Fiscal reaction function with IRAP-rates

dep. var. = IRAP	(1) FON	(2) core-periphery
$IRAP_{t-1}$	-0.39	0.35
	(1.16)	(0.76)
$(wIRAP)_{it}$	-2.46	10.88*
	(3.64)	(5.67)
Population	4.37E-08	-6.94E-08
	(2.15E-07)	(5.7E-08)
GDP	-5.68E-11	-1.52E-12
	(7.08E-11)	(4.03E-11)
constant	-0.65	0.66
	(0.86)	(0.44)
Observations	20	20
Sargan test	0.60	/

note: All regressions are in first differences. The dependent variable are the local tax rates, IRAP. Regressions (1) uses the first-order-neighbors and regression (2) uses a spatial variable where $w_{ij} = 1$ if region j is a member of the core while region i is a periphery-region and vice versa. ***, ** and * denote significance level of estimates at respectively 10, 5 and 1 percent levels.

2.7 Conclusion

This chapter studied regional differences in the effective tax rate (ETR) in Italy. Tax incentives to some types of companies, special tax regimes and the variety in levels of enforcement can result in differences in the effective tax rate amongst companies. Taking into account firm and sector characteristics, results show that companies in southern and mountain regions Basilicata, Campania, Sicilia, Sardegna, Abruzzo, Lazio and Valle D'Aosta have a significant lower effective tax rate than the overall average effective tax rate of 47.8 percent. These regions are also called the peripheral regions of Italy. But the question remains whether the regional differences in effective tax rates across Italian regions exist because of strategic interaction between the regions. For different definitions of neighbors, this chapter finds evidence of strategic interaction in effective tax rates between Italian regions. This indicates that a region will react to changes in the effective tax rate of neighboring regions. Moreover, the results show that the core (north and central regions[19]) and periphery (Southern regions[20]) strategically interact as well. If a periphery region decreases its IRAP tax rate, core regions will react by also decreasing their tax rate in order not to widen the gap in tax rates too much and vice versa.

[19]Piedmonte, Lombardia, Trenito Alto Adige, Friuli-Venezia Grulia, Veneto, Liguria Emilia-Romagna, Toscana, Umbria, Marche and Molise

[20]Basilicata, Campania, Sicilia, Sardegna, Abruzzo, Lazio, Puglia, Calabria and Valle D'Aosta

2.8 Appendix

Figure 2.5: Regional map of Italy

Table 2.9: Ranking ETR by sector, average 1993-2003

NACE	Description sector	Average ETR
63	Supporting and auxiliary transport activities; activities of travel agencies	0.517
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	0.516
51	Wholesale trade and commission trade, except of motor vehicles and motorcycles	0.511
50	Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	0.510
80	Education	0.509
75	Public administration and defence; compulsory social security	0.506
72	Computer and related activities	0.502
85	Health and social work	0.493
17	Manufacture of textiles	0.493
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0.491
29	Manufacture of machinery and equipment n.e.c.	0.489
18	Manufacture of wearing apparel; dressing and dyeing of fur	0,489
36	Manufacture of furniture; manufacturing n.e.c.	0,488
28	Manufacture of fabricated metal products, except machinery and equipment	0,487
74	Computer and related activities	0.487
33	Manufacture of medical, precision and optical instruments, watches and clocks	0.481
31	Manufacture of electrical machinery and apparatus n.e.c.	0.479
52	Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	0.476
25	Manufacture of rubber and plastic products	0.471
26	Manufacture of other non-metallic mineral products	0.466
23	Manufacture of coke, refined petroleum products and nuclear fuel	0.465
14	Other mining and quarrying	0.463
22	Publishing, printing and reproduction of recorded media	0.462

Table 2.9:Ranking ETR by sector, average 1993-2003, continued

NACE	Description sector	Average ETR
45	Construction	0.461
90	Sewage and refuse disposal, sanitation and similar activities	0.459
15	Manufacture of food products and beverages	0.457
24	Manufacture of chemicals and chemical products	0.455
21	Manufacture of pulp, chapter and chapter products	0.453
32	Manufacture of radio, television and communication equipment and apparatus	0.450
55	Hotels and restaurants	0.448
41	Collection, purification and distribution of water	0.448
37	Recycling	0.440
27	Manufacture of basic metals	0.438
35	Manufacture of other transport equipment	0.433
30	Manufacture of office machinery and computers	0.426
60	Land transport; transport via pipelines	0.419
71	Renting of machinery and equipment without operator and of personal and household goods	0.417
73	Research and development	0.408
34	Manufacture of motor vehicles, trailers and semi-trailers	0.406
91	Activities of membership organizations n.e.c.	0.398
93	Other service activities	0.398
40	Electricity, gas, steam and hot water supply	0.372
62	Air transport	0.352
2	Forestry, logging and related service activities	0.352
16	Manufacture of tobacco products	0.346
1	Agriculture, hunting and related service activities	0.345
70	Real estate activities	0.338
61	Water transport	0.302
64	Post and telecommunications	0.301

Table 2.9:Ranking ETR by sector, average 1993-2003, continued

NACE	Description sector	Average ETR
92	Recreational, cultural and sporting activities	0.300
11	Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying	0.256
13	Mining of metal ores	0.224
5	Fishing, operation of fish hatcheries and fish farms; service activities incidental to fishing	0.218
10	Mining of coal and lignite; extraction of peat	0.000

Table 2.10: Data-appendix

Variables	Definition
ETR	= corporate taxes paid/profit before tax
Firm size	= log(number of employees) or log(total assets)
Capital intensity	= Tangible fixed assets/total assets
R&D intensity	= Intangible fixed assets/total assets
LT leverage	= long-term debt/total assets
ST leverage	= short-term debt/total assets
carry forward	a dummy variable = 1 if the firm made a loss in the previous period
Foreign ownership	a dummy variable = 1 if the shares of a firm are for at least for 50% in hands of a foreign shareholder, 0 otherwise
Foreign subsidiaries	a dummy variable = 1 if the firm i directly owns at least 50% of the shares of a foreign firm, 0 otherwise
Firm age	2006 - startup year of the firm
ETR 2	= corporate taxes paid/total assets
ROA	= return on assets = profit/total assets
Year	Dummy variables for each year from 1994 and 2003, 1993 = reference
Sector	Dummy variables for all 2-digit NACE industries, Nace 1 = reference
Regional	Dummy variables for 19 regions, Umbria= reference

total assets= tangible fixed assets + intangible fixed assets + current assets

Chapter 3

Spatial Tax Competition in the EU15

3.1 Introduction

Decreasing tax rates is especially a European issue. Corporate taxes dropped the past 10 years by 12 percentage points in the EU versus only 6 percentage points in non-EU OECD countries. Another European trend is the compensation of declining tax rates with increasing taxable income. As a result several studies conclude that tax competition in official tax rates is present, but not in terms of effective tax rates (Devereux et al. (2002) and Vandenbussche & Crabbé (2006)). This chapter analyzes strategic tax setting in the 'old' EU14 as a reaction to the tax rates in the new member states. Prior research has shown that FDI is sensitive to tax rates (Mooij & Ederveen 2003). Also for Eastern European countries the corporate tax rate is an effective instrument to attract FDI (Disdier & Mayer (2004) and Bellak & Leibrecht (2005)). According to Devereux & Griffith (1998) the effective average tax rate plays a role for US multinationals in entering the European market, but they did not compare with official tax rates. In contrast, Buettner & Ruf (2005) show that German multinationals take into account the official tax rate, rather than the effective tax rate in their location decisions. Therefore, this chapter will focus on statutory tax rates,

[0]This chapter is based on co-authored work with H. Vandenbussche

rather than effective tax rates in the EU25.

Especially since the entry of the new member States, European tax competition has become fierce. Some earlier studies find that European countries set their corporate tax rates interdependent (Devereux et al. (2008), Altshuler & Goodspeed (2002), Redoano (2003) and Ruiz & Gerard (2007)), but none of these studies investigated spatial tax competition between the 'old' EU14 and the new member states. This is where the aim of this chapter lies: we study to what extent geographical proximity to low tax areas like the new member states, affects corporate tax rates in the former EU14 countries[1]. We expect that tax competition will not be equally fierce between all countries. Some countries will find decreasing corporate tax rates a priority, while others focus on other economic issues. The question then raises whether the geographical position of European countries vis- à-vis the new member states (low tax countries) influences the intensity of tax competition. Does the former EU14 anxiously look at tax reforms in the new, low tax, member states and adjust their taxes accordingly?

For this purpose, we first develop a spatial tax competition model with countries competing to attract a multinational. The model predicts that tax competition is more intense between geographically close countries. Second, the outcome of the theoretical model is tested using a fiscal reaction function.We test whether and which EU14 countries respond to changes in the tax rates of the new EU member states. The results indicate that distance to these new members matters for tax competition i.e. EU14 countries closer to the EU10 like Germany and Austria are more responsive than countries further away from the EU10 such as France, Belgium and the Netherlands.

The chapter is organized as follows. First, section 3.2 shows some stylized facts of corporate taxes in Europe. Section 3.3 reviews the related literature on tax mimicking and section 3.4 develops a theoretical framework. Section 4.4 explains the empirical methodology and the data. Section 4.6 shows the results and 4.7 discusses the robustness checks. Finally, section 4.9 briefly concludes our main results.

[1]The EU14 includes Germany, Austria, Italy, Spain, Portugal, Belgium, Luxembourg, the Netherlands, Finland, Sweden, Denmark, UK, France and Greece.

3.2 Corporate taxes in Europe: stylized facts

Falling corporate tax rates is especially an European issue. Figure 3.1 illustrates the evolution of corporate tax rates in OECD6[2] and EU countries. We observe that the tax rate in the OECD (-3%) remained more stable in comparison to the sharp decrease in tax rates of the EU25 (-10%). Within Europe, both the older EU15 countries and the 10 new member states have known a decrease of 10% in their corporate tax rates. The figure also shows that during the whole period, corporate tax rates in the EU15 have been higher than in the new member states.

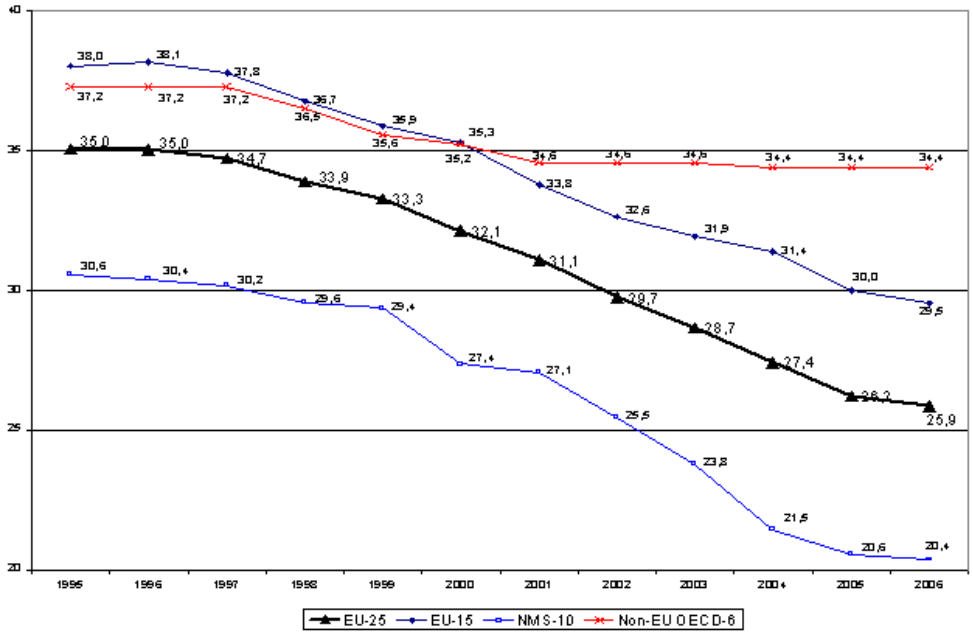

Figure 3.1: Evolution tax rates in OECD and EU, 1995-2006

Source: European Commission

Although traditional tax competition theories predict a downward pressure on corporate taxes when capital mobility increases (for an overview see Wilson (1999) and Bretschger & Hettich (2002)), empirical studies do not find evidence of a race to the bottom in corporate taxes (Krogstrup (2004),

[2]OECD6= Australia, Canada, Japan, Mexico, New Zealand and USA

Baldwin & Krugman (2004), Salvatore (2002), Bénassy-Quéré et al. (2007), Desai (1999), Mendoza & Tesar (2004) and Stewart & Webb (2006)). While statutory taxes decreased in the EU, tax bases were broadened such that tax revenues on corporate incomes remained stable (Devereux et al. (2002), Buijinck et al. (2002) and Vandenbussche & Crabbé (2006)). Figure 4.3 reports the evolution of the average effective tax rate of the EU15 countries and the 10 new member states (EU10). In contrast to the nominal tax rate, the aggregate effective tax rate remained quite stable and even increased in the period 1993-2003.

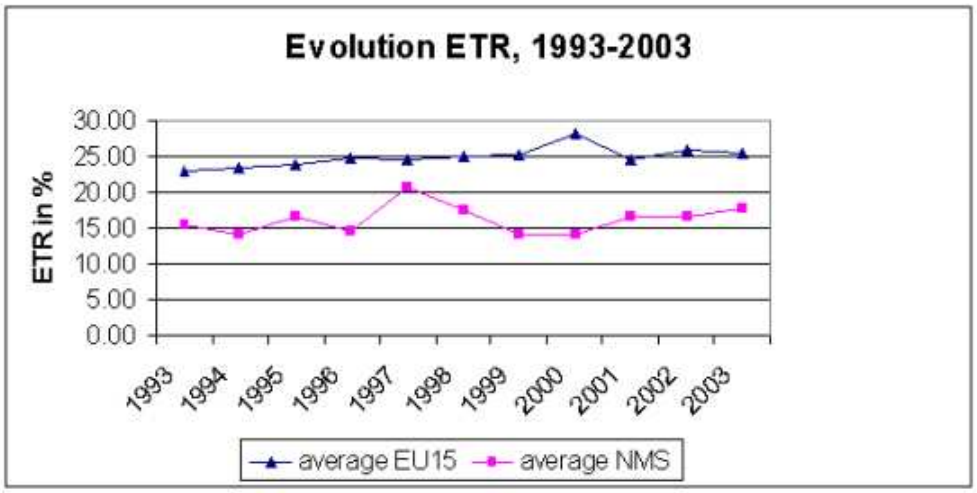

Figure 3.2: Evolution Effective Tax Rates (ETR) in Europe
Source: Amadeus data

Moreover, a study by Buettner & Ruf (2005) shows that German multinationals take into account the statutory tax rate, rather than the effective tax rate in their location decisions. Therefore, we will measure taxes by the nominal tax rate instead of the effective tax rate.

We start by some stylized facts, Figure 3.3 splits up the EU15 countries into neighbors of the new member states and non-neighbors of the new member states. Neighbors are defined as countries with a common land or water border with one or more new EU members, for example Austria and Italy are neighbors of Slovenia. The average nominal tax rate of the new member states and Ireland are presented separately. Figure 3 not only

illustrates that the older EU15 countries have a higher tax rate than the new member states, but also that neighbors compared to non-neighbors of the new member states have a much larger absolute decrease in their average corporate tax rate (12% versus 6%). While the average tax rate in the non-neighbors remained stable for a long period, the average tax rate in the neighbors decreased rapidly and dived under the average tax rate of the non-neighbors in 2000. These reforms could indicate that neighbors of the new member states are subject to more intense tax competition as a result of their geographical proximity to the Eastern low tax areas.

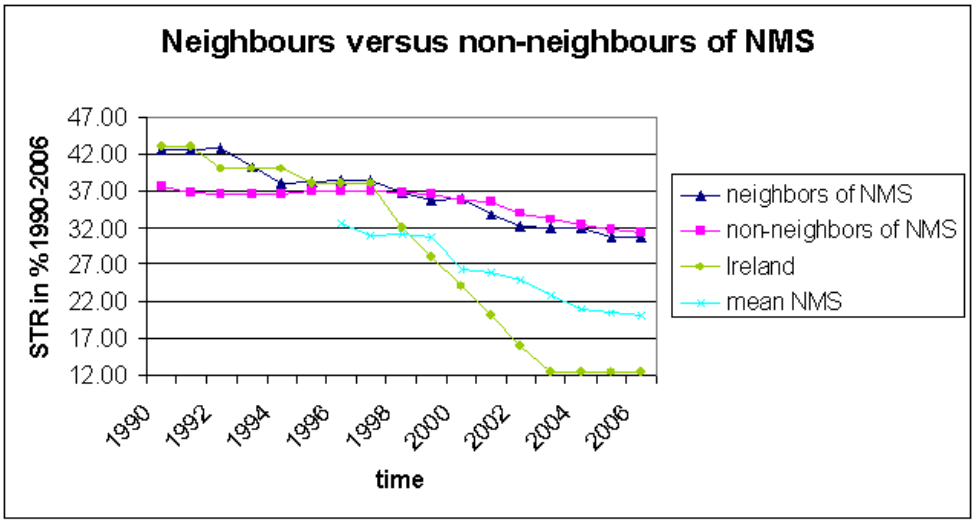

Figure 3.3: Tax Rate of the neighbors versus non-neighbors of the new member states

Neighbors: Germany, Austria, Denmark, Finland, Sweden, Italy and Greece; Non-neighbors: Spain, France, UK, Netherlands, Belgium, Luxembourg and Portugal The STR is not weighed. Source: Vandenbussche & Crabbé (2006), extra data included for 2005 and 2006.

To gain more insight in the declining corporate tax rates of the neighbors and non-neighbors of the new member states, Figure 3.4 illustrates the corporate tax rates for the individual countries. This figure indicates that neighbors of the NMS not only have the largest decrease in corporate tax rates, but also started decreasing much faster. Almost all neighboring countries started their decrease in corporate taxes around 1992-1993, while the

decrease in taxes of the non-neighbors started only around 1996-1997. Moreover, we observe that this decrease in corporate tax rates is independent of the size of the country. For example the tax rate of Germany decreased by 18.2% during the period, while the tax rate of a large non-neighbor country like France only decreased by 3.7%.

3.3 Related Literature on Fiscal Reaction Functions

Mukand & Rodrik (2005) point out that countries mimic policies of their neighbors even when this is not the best solution for their economic situation. This mimicking behavior can also be found in (corporate) tax competition. Theoretical and empirical work point out that countries or regions do not set their tax rate independently, but take into account the tax rates in related countries or regions. Countries or regions do this in accordance with two reasons: yardstick competition and capital tax competition. The first theory poses that voters judge policy-makers on their performance by comparing tax rates of neighboring countries. Therefore, politicians, to ascertain their re-election, will 'tax mimic' their neighbors' tax rate. The second theory argues that countries compete to attract capital by setting lower tax rates. It is not always clear whether the presence of 'tax mimicking' comes from yardstick or tax competition, since the empirical method for both theories is the same (Brueckner 2003). With regard to corporate taxes, Devereux et al. (2008) argue that yardstick competition can be eliminated as a possible explanation. The reason is that corporate taxes are not a critical topic for voters to evaluate policy-makers, certainly because most voters do not even know the domestic corporate tax rate. On the other hand, Bordignon (2007) comes to the conclusion that yardstick and fiscal competition usually work one against the other. In this chapter, we cannot distinguish between both forms of competition. Our goal is to study intergovernmental competition in corporate taxes in order to attract foreign investment.

Empirical studies estimate a fiscal reaction function of a certain jurisdiction which relates the tax rate of this jurisdiction to its own characteristics

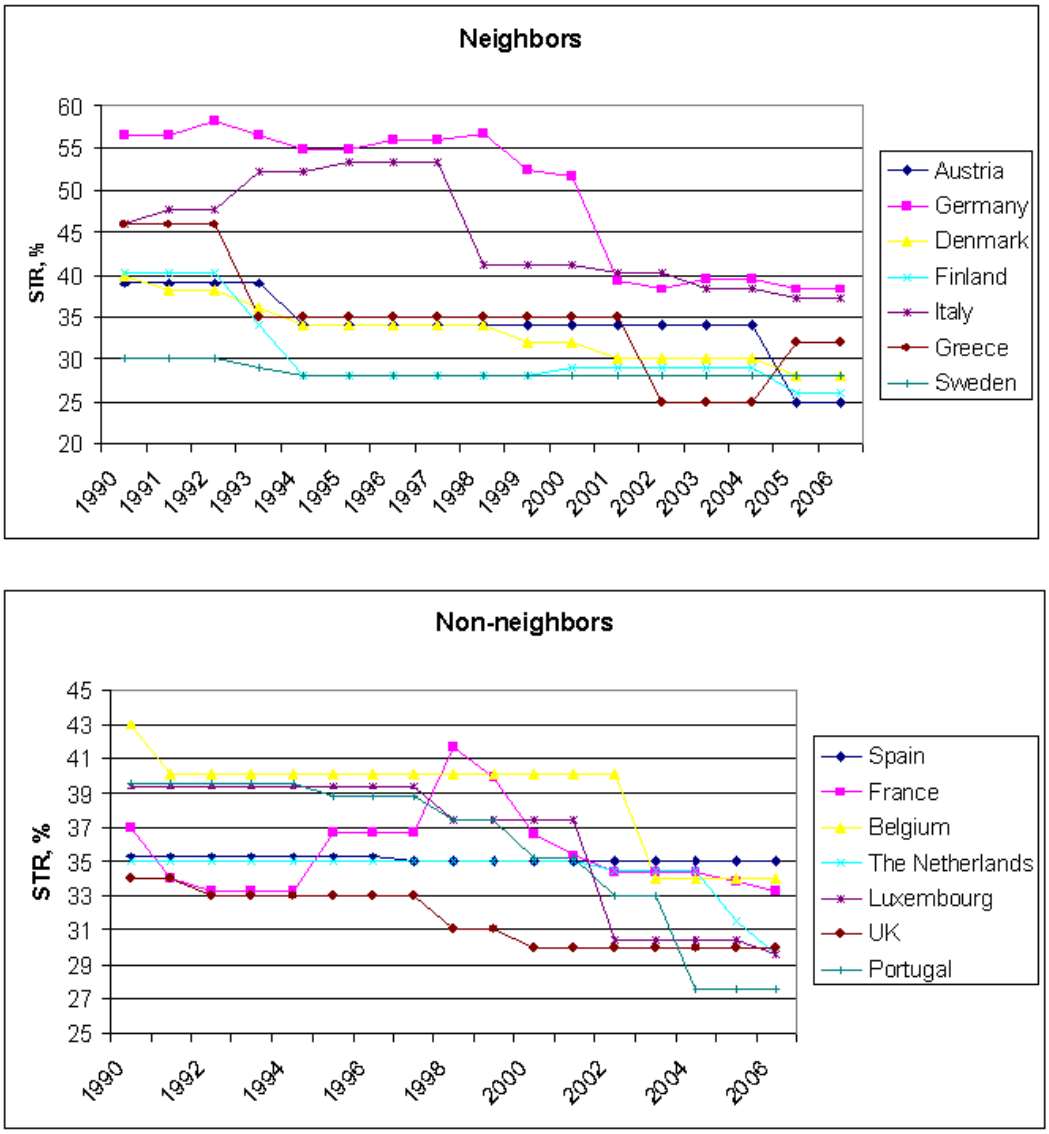

Figure 3.4: Evolution of Statutory Tax Rates in Europe
Neighbors: Germany, Austria, Denmark, Finland, Sweden, Italy and Greece;
Non-neighbors: Spain, France, UK, Netherlands, Belgium, Luxembourg and Portugal
The STR is not weighed. Source: KPMG

and to the tax rate in competing jurisdictions. When tax rates are chosen strategically, the reaction function has a nonzero slope indicating that competitors' tax rates influence the given jurisdiction's choice. The sign of the slope can be positive or negative depending on the specific parameter values. If strategic interaction is absent, the slope of the reaction function is not significantly different from zero (Brueckner & Saavedra 2001). This methodology has been used in many articles on local property, business or personal taxes (Besley & Case (1995), Bordignon et al. (2002), Heyndels & Vuchelen (1998), Brueckner (1998), Brett & Pinkse (2000), Brueckner & Saavedra (2001), Carlsen et al. (2005), Buettner (2001), Ladd (1992), Allers & Elhorst (2005), Hayashi & Boadway (2001), Allers & Elhorst (2005), etc) and government expenditure levels (Ollé (2003), Figlio et al. (1999), Revelli (2003), Case et al. (1993), Geys (2006), Baicker (2005), Werck et al. (2007), etc) across jurisdictions within one country[3].

Devereux et al. (2008) analyze strategic tax competition in 21 OECD countries in the period 1982-1999. They find that countries strategically compete over the statutory tax rate and EATR[4] and that countries with relatively high effective tax rates react more strongly to tax rates in other countries. A second study examining strategic tax competition between countries and the first using only EU countries is Altshuler & Goodspeed (2002). They find that EU countries strategically compete with geographically close countries using corporate tax revenues over GDP, but not using personal income tax revenues. They also conclude that since the US tax reform of 1986, European countries compete to a lesser extent with the US on corporate tax rates. A second study using exclusively European countries is Redoano (2003). She shows that tax competition mainly occurs between geographically close countries using statutory tax rates for 13 European countries during the period 1980-1995. Finally, Ruiz & Gerard (2007) find empirical evidence of limited 'tax mimicking' between neighboring EU15 countries using statutory and effective tax rates during the period 1989-2001. They argue that possible converging tax rates in the EU15 can explain their weaker result of spatial tax competition.

[3]See Brueckner (2003) for an overview of empirical studies on strategic interaction

[4]EATR= effective average tax rate calculated using the forward looking method, see Devereux et al. (2002).

This chapter will extend the limited number of studies using fiscal reaction functions on exclusively European Union countries. In particular, the impact of changes in the tax rates of the new member states (EU10) on the tax rates of the EU14 will be the focus. Furthermore, different definitions of neighbors will be used to gain insights in the spatial tax competition process in the EU25 during the period 1993-2006.

3.4 The model

A first step in illustrating which role distance to a peripheral region or country has in tax competition is to set up a theoretical framework. In our model two countries A and B are located on a fixed distance x from each other as illustrated in Figure 3.5.

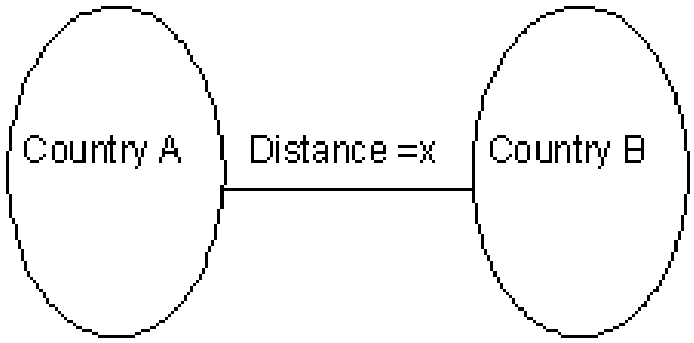

Figure 3.5: Spatial tax competition: a theoretical framework

Country A and B compete for the location of a single firm, a multinational that does not compete with the domestic firms[5]. Profits by the multinational are repatriated to third country C. This multinational will set

[5]The assumption that the MNE is a monopoly with a competitive fringe and so does not compete with domestic firms is needed to keep the model tractable analytically, without changing the qualitative implications of the model.

up in only one of the countries and sell to the other country by exporting. The locations are symmetric in the sense that set up costs and marginal production costs are assumed to be the same, therefore in comparing location A and B they will not affect the location decision of the multinational and can be dropped from the analysis. To export to the other country, the multinational will have to pay a transportation cost c which is related to the distance x between the countries.

A final assumption is that country A is a more developed country in terms of infrastructure, technology, etc. While country B is less attractive for production, we call it a peripheral country. This assumption is translated in a larger market size for country A, indicated by M, than for country B, indicated by m, ($M >> m$). The order of events in the model is as follows.

- Stage 1: Governments A and B set their tax rate simultaneously[6].
- Stage 2: the multinational makes its location decision.
- Stage 3: the multinational sells and exports an equilibrium output that maximizes its profits.

We solve the model backwards, introducing additional formal notation as required[7]. In stage 3, the multinational (MNE) sells and exports a certain output to maximize its profits. Using the inverse demand functions of both countries A and B

$$\begin{aligned} P_A &= (M - Q_A) \\ P_B &= (m - Q_B), \end{aligned} \tag{3.1}$$

where P_A and P_B are the prices and Q_A and Q_B the domestic outputs, the after-tax profit of the multinational if it sets up in A is:

$$\pi_A = ((M - Q_A)Q_A + (m - Q_{AB})Q_{AB} - cxQ_{AB})(1 - t_A) \tag{3.2}$$

[6]We acknowledge that there might be a time inconsistency problem, but we assume here that both countries commit to the tax rate they have set in stage 1 (Haufler & Wooton 2001).

[7]The detailed computations are described in the Appendix.

and if it sets up in B is:

$$\pi_B = [(m - Q_B)Q_B + (M - Q_{BA})Q_{BA} - cxQ_{BA}](1 - t_B) \quad (3.3)$$

where Q_{AB} and Q_{BA} are the exported outputs, t_A (t_B) is the corporate tax rate of country A (B) and $0< t_A(t_B) <1$.

Maximizing these after-tax profits leads us to the equilibrium outputs in A and B respectively. If the multinational sets up in A:

$$Q_A^* = \frac{M}{2} \; and \; Q_{AB}^* = \frac{m - cx}{2} \quad (3.4)$$

and if the multinational sets up in B:

$$Q_B^* = \frac{m}{2} \; and \; Q_{BA}^* = \frac{M - cx}{2} \quad (3.5)$$

In order for the outputs to be positive, the following conditions must be true: $M > cx$ and $m > cx$. Using the equilibrium outputs in equations (3.4) and (3.5) gives the equilibrium after-tax profits in the case the multinational would set up in A or B respectively:

$$\begin{aligned} \pi_A^* &= \frac{M^2 + (m - cx)^2}{4}(1 - t_A) \quad (3.6) \\ \pi_B^* &= \frac{m^2 + (M - cx)^2}{4}(1 - t_B) \end{aligned}$$

The second stage of the model deals with the MNE's location decision. The multinational will be indifferent in its location preference when its after-tax profit in country A equals the after-tax profit it could earn in country B.

$$\pi_A^* = \pi_B^* \quad (3.7)$$

From this we can derive the 'indifference' tax rate:

$$\begin{aligned} \Rightarrow t_A^{Indiff} &= -(1 - t_B)\left(\frac{m^2 + (M - cx)^2}{M^2 + (m - cx)^2}\right) + 1 \quad (3.8) \\ &= \frac{2cx(M - m) + t_B(m^2 + (M - cx)^2)}{M^2 + (m - cx)^2} \end{aligned}$$

For this tax rate set by country A, the multinational is indifferent between setting up in country A or B. The 'indifference' tax rate is among others a

function of the tax rate of the other country, market size of both countries, transport cost and distance x.

As a consequence, country A has two options in the first stage where both countries set their tax rates simultaneously. Country A can set its tax rate below or above t_A^{Indiff} and both options will result in a different welfare function. We assume that the welfare function consists of consumer surplus (CS), and tax revenue from taxing the firm's profit. As in Haufler & Wooton (2001) the home base of our multinational is outside country A and B so that after-tax profits will be shifted abroad and do not enter the welfare function[8] The welfare function (W) in general can thus be written as follows

$$W_i = CS_i + t_i \frac{\pi_i^*}{1 - t_i} \tag{3.9}$$

If country A chooses option 1 and sets a tax rate a fraction lower than t_A^{Indiff}, then the multinational will find country A more attractive and will locate in A. Country A will receive tax incomes from taxing the firm's profit. On the other hand, if country A chooses to set its tax rate above t_A^* (option 2), then the firm will find country B a better location. As a consequence, country A loses its tax income and consumer surplus in this option will be lower than in the first option due to transport costs (see Appendix for a proof).

This argument can be summarized as follows

$$\begin{aligned} t_A < t_A^* \quad &\Rightarrow \quad W_{A1} = CS_1 + t_A \frac{\pi_A*}{1 - t_A} \\ OR & \\ t_A > t_A^* \quad &\Rightarrow \quad W_{A2} = CS_2 \end{aligned} \tag{3.10}$$

It can be shown that welfare for A under option 1 is higher than under option 2, therefore country A will set its tax rate a fraction epsilon below t_A^{Indiff}. The same result is achieved when we maximize the welfare in option 1. Maximizing this welfare shows that the optimal tax rate should be as large

[8]Including the firm's after-tax profits into the welfare function would not change our basic result, on the contrary it would strengthen the outcome. But our approach makes the algebra simpler.

as possible.

$$\frac{\delta W_A}{\delta t_A} = \frac{M^2 + (M - cx)^2}{4} \tag{3.11}$$

This indicates that the optimal tax rate for country A should be as close as possible to t_A^{Indiff} or in other words, country A will set its tax rate a fraction ξ below the tax rate where the firm is indifferent between locations, t_A^{Indiff}:

$$t_A^* = \frac{2cx(M - m) + t_B(m^2 + (M - cx)^2)}{M^2 + (m - cx)^2} - \xi. \tag{3.12}$$

The same story holds for country B such that

$$t_B^* = \frac{2cx(m - M) + t_A(M^2 + (m - cx)^2)}{m^2 + (M - cx)^2} - \xi \tag{3.13}$$

From the above equation (3.12), it can be verified that t_A^* is larger than t_B^* as long as $t_B^* > -1$, which was an assumption ($0 < t_B^* < 1$. In addition, it can be verified that the tax rate of country A will always be positive if $M > m$, which is an assumption of the model. The tax rate for country B can be negative even under this assumption of $M > m$, which implies that country B would be willing to subsidize the multinational to attract its settlement to country B. Moreover, there is a positive relation between the market size and the tax rate, indicating that larger countries can set higher tax rates as in Haufler & Wooton (2001) (see proof in appendix). Furthermore, equations (3.12) and (3.13) show that both tax rates are strategic complements ($\frac{\delta t_A^*}{\delta t_B^*} > 0$): a higher tax in country B will lead country A to set a higher tax rate as well. This indicates that if country B increases its tax rate, country A can also set a higher tax rate without inducing the firm to move to country B. But it also works the other way around, if country B decreases its tax rate, country A must set a lower tax rate in order not to lose the multinational.

This brings us to the main question in this chapter, namely what happens if country A would be located closer or further away from the peripheral country B. In other words what would happen to the tax rate of A if distance x between the countries was smaller? For this we take the comparative static of the equilibrium tax rate in A with respect to x:

$$\frac{\partial t_A^*}{\partial x} = 2c(1 - t_B)(M^2 + m^2 - c^2x^2)(M - m) > 0 \tag{3.14}$$

Equation (3.14) implies that the tax rate of country A is a positive function of distance between the two countries. This indicates that a country A closer to the low tax country B will set lower taxes. This suggests that spatial dimensions matter in tax competition. A country closer to low tax region is subject to more tax competition and the model predicts a lower tax rate. Take for example Germany, adjacent to a new member state Poland, and the UK, not neighboring a new member state. A multinational willing to invest in Germany will reconsider this strategy and may set up in Poland due to lower labor costs and taxes. Since Germany is a neighbor, transport costs will be low. But if the multinational initially wants to invest in the UK, setting up a production center in Poland will be less obvious. The outcome of the theoretical model can be summarized in the following propositions.

PROPOSITION 1: There is spatial tax competition and spatial reaction functions are upward sloping.
PROPOSITION 2: EU14 countries closer to the new member states experience more tax competition and will set lower tax rates.

3.5 Methodology and Data

To test these theoretical propositions empirically, a fiscal reaction functions for the EU14 countries will be estimated. As explained in section 2.3, a fiscal reaction function has a nonzero slope when countries strategically react to tax rates in other countries. We investigate the reaction of the EU14 on the new member states (NMS) for the period 1993-2006. We do this at the basis of the following specification:

$$\begin{aligned} TAX_{i_{EU14},t} &= \beta_1 TAX_{i_{EU14},t-1} + \beta_2(\sum_{i \neq j} w_{ij} TAX_{j_{NMS},t}) \\ &\quad + \beta_3 X_{i,t} + \alpha_i + \varepsilon_{it} \end{aligned} \tag{3.15}$$

In the above expression (3.15), the dependent variable TAX is the statu-

tory tax rate of country i in the EU14[9] at time t[10]. On the right hand side, the model includes the lagged dependent TAX variable, the weighed tax rate of the 10 new member states[11] ($w_{ij}TAX_{jNMS}, t$), a set of country control variables (X)[12] such as population density, GDP per capita and the lagged personal income tax rate[13], country fixed effects (α_i) and time dummies (δ_t).

The weighed tax rates of the new member states is our main variable of interest. This variable is the weighed sum of the statutory corporate tax rates of the new EU10 member states:

$$\begin{aligned}(wTAX)_{it} &= \sum_{j \neq i} w_{ij} TAX_{jt} \\ \forall i : \sum_{j} w_{ij} &= 1\end{aligned} \tag{3.16}$$

For the weight, different measures from the theory will be used. According to Besley & Case (1995), spatial models typically use geographical weights for 2 reasons. First, geographic neighbors are likely to experience similar shocks and therefore neighbors' tax rates are more informative than tax rates in far away districts. A second reason is that information about policy decisions in nearby countries spreads quicker. To capture our research question, we will use here the inverse distance between the capital cities of countries of the EU14 and the new member states. The data on distance is collected from the CEPII database. Distance is measured as the distance between capital cities following the great circle formula, which uses latitudes and longitudes of the cities and incorporates the internal distance of the country based on areas (Head & Mayer 2002)[14].

[9]EU14= Belgium, Netherlands, Luxembourg, Germany, France, Spain, Portugal, UK, Denmark, Sweden, Finland, Austria, Italy and Greece

[10]All data on corporate tax rates are collected from KPMG (2006)'s tax surveys and were available for 1993-2006.

[11]Poland, Slovakia, Czech Republic, Slovenia, Hungary, Lithuania, Latvia, Estonia, Malta and Cyprus

[12]The control variables, population density and GDP per capita are collected from the world development indicators (WDI), while the personal income tax rate is available in the OECD database until 2004

[13]personal income tax rate is lagged by one period since this variable is possible endogenous

[14]Other studies use more sophisticated measures of distance (Davis & Weinstein 2003).

In addition, six other weighing schemes will be used to gain insight in the EU14 tax competition game. The most widely used definition of neighbors is based on a common border (contiguity). In this definition the weight w_{ij} equals 1 if country i has a common land or water border with country j and 0 otherwise. A third spatial weight is based on the idea that also neighbors of second order can be affected by changes in the corporate tax rates of the EU10 countries. In this case, w_{ij} equals 1 if country i is has a common border with an adjacent neighbor of country j and 0 otherwise. The fifth weight is the share of trade (export + import) with country j in GDP of country i[15]. Finally, the sixth weighing scheme is based on the inverse distance between GDP per capita and is constructed as follows[16]:

$$\frac{1/(GDP_{i,t} - GDP_{j,t})}{\sum_j 1/(GDP_{i,t} - GDP_{j,t})} \tag{3.17}$$

Note that these last two weights, trade share and GDP per capita are allowed to be time variant[17]. All weights are normalized so that their sum equals 1.

By estimating specification (3.15) several econometric issues pop up. First, including a lagged dependent variable in a fixed effects model will lead to correlation since fixed effects are time invariant (Woolridge 2003). A possible solution is to estimate equation (3.15) in first differences in order to get rid of this correlation. Taking first differences will lead to correlation between the lagged dependent variable in differences and the error term in differences, thus the lagged dependent variable in differences should be instrumented with lags of two or more periods. Second, our variable of interest, the weighed tax rate of the NMS, could be endogenous: tax rates of the EU14 will influence the tax rates of the new member states as well. To solve this problem, the instrumental variables method (2SLS) is frequently applied in the fiscal reaction literature (Brueckner (2003), Altshuler & Goodspeed (2002), Redoano (2003), Heyndels & Vuchelen (1998), Brett & Pinkse (2000), Carlsen et al. (2005), Ollé (2003), Figlio et al. (1999),

But for our research question, distance between capital cities is a good indicator of distance between countries.

[15]Trade data is collected from IMF database and GDP data is collected from Eurostat

[16]Data on GDP per capita is collected from Eurostat.

[17]Except for Redoano (2003) previous studies used weights based on the average of a variable over time.

Revelli (2002), Ladd (1992), Buettner (2003), Geys (2006), Baicker (2005), Werck et al. (2007) and Allers & Elhorst (2005)). Table 3.1 shows several specification of (3.15) that were tested.

The first column in Table 3.1 estimates equation (3.15) using OLS and country fixed effects. The second column uses an autoregressive fixed effects model to include the autocorrelation of the EU14 tax rates. As explained above, an OLS estimation procedure is not correct since the weighed tax rates of the NMS are endogenous. Therefore, column (3) estimates a fixed effects model and instruments the endogenous variable, $WTax_{NMS,t}$. As a consequence the new estimation procedure will be:

$$First\ stage: \quad \sum_{i \neq j} w_{ij} TAX_{j_{NMS},t} = \alpha_1 \sum_{i \neq j} w_{ij} X_{j_{NMS}} + \alpha_2 X_{i_{EU14}} + \beta_3 \rho_{jt} \tag{3.18}$$

$$\begin{aligned} Second\ stage: \quad & TAX_{i_{EU14},t} = \beta_2 (\sum_{i \neq j} w_{ij} \hat{TAX}_{j_{NMS},t}) \\ & + \beta_3 X_{i_{EU14},t} + \alpha_{i_{EU14}} + \varepsilon_{it} \end{aligned}$$

Finally, column (4) will include a lagged dependent variable. Taking into account that this is correlated with the fixed effects, we will take first differences and instrument the lagged dependent variable in differences with lags of 2 or more periods. In symbols, our final estimation procedure is:

$$\begin{aligned} First\ stage: \quad & \Delta \sum_{i \neq j} w_{ij} TAX_{j_{NMS},t} = \alpha_1 \Delta \sum_{i \neq j} w_{ij} X_{j_{NMS},t} \\ & + \alpha_2 \Delta X_{i_{EU14},t} + \Delta \rho_{jt} \end{aligned} \tag{3.19}$$

$$\begin{aligned} Second\ stage: \quad & \Delta TAX_{i_{EU14},t} = \beta_1 \Delta TAX_{i_{EU14},t-1} + \beta_2 \Delta X_{i_{EU14},t} \\ & + \beta_3 \Delta (\sum_{i \neq j} w_{ij} \hat{TAX}_{j_{NMS},t}) + \Delta \varepsilon_{it} \end{aligned} \tag{3.20}$$

The result shows that a decrease by 10% in the tax rates of the new member states (EU10), will induce a reduction by 18% in the tax rates of the EU14 countries that are on a close distance to the new member states. The p-value of the Sargan test is larger than 0.1 and thus implies that our instruments are valid.

Table 3.1: Model construction

dep var.=tax$_{EU14}$	(1) xtreg	(2) xtregar	(3) xtivreg, fe	(4) IV, lag, fe
Tax$_{i,t-1}$				-0.09
				(0.13)
WTax$_{NMS,t}$	0.79***	0.16	0.97***	1.83***
	(0.1)	(0.14)	(0.17)	(0.86)
Income tax$_{i,t-1}$	-0.06	0.05	-0.04	-0.41
	(0.14)	(0.21)	(0.14)	(0.31)
GDP per capita$_{i,t}$	0.001***	-0.0004	0.001***	0.002**
	(0.0002)	(0.0005)	(0.0004)	(0.001)
Population density$_{i,t}$	0.11	-0.27	0.15	0.38
	(0.09)	(0.24)	(0.1)	(0.35)
Constant	-20.65	82.66***	-39.92*	0.68
	(16.59)	(8.37)	(22.53)	(0.82)
Obs	169	156	169	156
R squared	0.43	0.04	0.42	
Sargan test (p-value)				0.8

Standard errors are in parentheses. The instruments used for $WTax_{NMS,t}$: the proportion of the population younger than 14 years, population density and the number of active residents. note:***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

Table 3.2: Estimation results

dep var.=tax$_{EU14}$	(1) Ireland	(2) Neighb.	(3) Non-neighb.	(4) '95-'06	(5) lag	(6) instit.
Tax$_{i,t-1}$	-0.04	-0.14	-0.06	-0.09	-0.07	-0.12
	(0.09)	(0.22)	(0.15)	(0.13)	(0.13)	(0.14)
WTax$_{NMS,t}$		1.99*	0.17	1.8**	0.3	1.62*
		(1.22)	(0.34)	(0.86)	(0.34)	(0.94)
WTax$_{NMS+Ireland,t}$	0.01*					
	(0.01)					
WTax$_{non-neighbors,t}$		-1.2				
		(1.03)				
WTax$_{neighbors,t}$			1.44			
			(1.7)			
WTax$_{NMS,t-1}$					1.08*	
					(0.61)	
Income tax$_{i,t-1}$	-0.15	-0.23	0.09	-0.41	-0.36	-0.35
	(0.2)	(0.49)	(0.23)	(0.82)	(0.33)	(0.31)
GDP per capita$_{i,t}$	0.001	0.003	0.0003	0.002*	0.002**	0.001*
	(0.001)	(002)	(0.001)	(0.001)	(0.001)	(0.001)
Population density$_{i,t}$	0.37	3.57	-0.02	0.38	0.34	0.32
	(0.29)	(3.23)	(0.19)	(0.35)	(0.37)	(0.34)
Constant	-0.18	-1.35	-0.08	0.68	-1.5**	0.57
	(0.5)	(1.54)	(0.61)	(0.82)	(0.66)	(0.99)
Obs	156	56	72	156	156	143
Sargan test (p-value)	0.06	0.8	0.19	0.8	0.6	0.31

Standard errors are in parentheses. The instruments used for $WTax_{NMS,t}$: the proportion of the population younger than 14 years, population density and the number of active residents. In column (6) the instruments for $WTax_{NMS,t}$ are an indicator of enterprise reforms, trade liberalization and competition policy. note:***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

3.6 Results

The estimation results of equation (3.19) are reported in Table 3.2. In all specifications in the table, EU14 countries react to tax changes in the new member states. Since Ireland's tax rate decreased sharply from 1997 onwards, this country was not included in the fiscal reaction function. But it is possible that the low tax rate of Ireland, provokes more intense tax competition in the other EU countries. In Column (1) of Table 3.2, Ireland is included in the group of distance weighed tax rates, $WTax_{NMS,t}$. The coefficient is still positively significant, indicating that EU14 countries react to tax changes in the new member states and Ireland.

Columns (2) and (3) split up the sample in direct neighbors (Italy, Germany, Austria, Finland, Sweden, Denmark and Greece) and non-neighbors (Belgium, Luxembourg, Netherlands, France, UK, Portugal and Spain) of the new member states (NMS). The estimations show that only the neighbors react to the tax rate of the new member states and that these neighbors. Moreover, the neighbors of the new member states do not react to tax rates of the NMS' non-neighbors. This result indicates very clearly that tax changes in the new member states affect mostly the neighbors of these countries. As a consequence, this might be the reason why Ruiz & Gerard (2007) find a weak tax mimicking result between neighboring EU15 countries. It is rather distance to a low tax country or region that matters in European tax competition.

Since Finland, Austria and Sweden only joined the European Union in 1995, column (4) estimates equation (3.19) for a shorter period 1995-2006. Also in this shorter period, the reaction of the EU14 on taxes in the new member states is still positively significant.

In general, tax competition models predict that tax rates are jointly determined and hence indicate endogeneity of $WTax_{NMS,t}$ (Devereux et al. 2008), (Brueckner 1998). But it seems very plausible that the government in each country sets its tax as a best response to taxes of the new member states in the previous period. Therefore, column (5) includes a lagged term of $WTax_{NMS,t}$. We observe that the simultaneous reaction is not significant anymore, while the lagged reaction is positive and significant. Although a Wald test cannot reject that coefficients of both variables are equal, this

would suggest that EU14 countries' react rather to taxes of the new member states in the previous period.

Finally, column (6) uses a different set of instrumental variables for $WTax_{NMS,t}$, namely institutional variables such as measures of enterprise reforms, trade liberalization and competition policy[18]. The result shows that EU14 countries react positively and significantly to taxes in the new member states. The Sargan test confirms the validity of the instruments, but is lower than the benchmark IV regression in column (4) of Table 3.1.

Two country control variables in estimations in Table 3.2 show the expected sign, but are not always significant. First, countries with higher incomes, as measured by GDP per capita, have higher corporate tax rates. This is consistent with the literature that a higher country income is related to higher demands for public services and thus higher corporate tax rates to finance these public services (Altshuler & Goodspeed 2002). Second, also consistent with the literature suggesting that tax competition will lead to a movement away from taxes on mobile factors toward taxes on immobile factors (Altshuler & Goodspeed (2002), Wilson (1999)), the coefficient on the lagged personal tax rate is negative. This indicates that a lower personal income tax rate might be compensated by a higher corporate tax rate.

3.7 Robustness checks

Table 3.4 reports some robustness checks of the previous results. Instead of estimating the reaction of the EU14 to the aggregate taxes of the NMS, column (1) splits up the NMS in smaller groups of countries: the Baltic states (Estonia, Lithuania and Latvia), Ireland and the 5 largest NMS (Slovenia, Slovakia, Czech Republic, Poland and Hungary). Cyprus and Malta are left out since these countries are very small and have almost no neighbors. Only the coefficient of the group of the 5 largest NMS (Slovenia, Slovakia, Czech Republic, Poland and Hungary) is positive and significant, implying that the EU14 reacts mainly to these 5 new member states.

Secondly, columns (2) to (5) test other weights of the NMS' taxes. First

[18]These institutional variables are collected from the EBRD reports

column (2) uses a dummy equal to 1 if country i is an adjacent neighbor of a NMS, while in column (2) the weight is a dummy equal to 1 if country i has a common border with an adjacent neighbor of an NMS. None of these weighed tax rates are significant. Possibly these types of weights are too roughly defined. Moreover, we could not find valid instruments for this variable as the Sargan p-values point out. In column (3) the weight is the share of trade with country j in GDP of country i. The argument is that EU14 countries might react more to taxes of their trading partners. The coefficient is positive and significant, indicating that EU14 countries react to taxes of the NMS in particular if these NMS are their trading partners. But the coefficient is very small. In column (5) we test whether EU14 countries compete over taxes against countries with similar economic characteristics. The result is positive, but not significant, which could imply that a geographical neighbor is more important than economic similarity in the fiscal reaction of EU14 countries to NMS[19].

Finally, the last column uses the effective tax rate of the NMS instead of the official tax rate. This reaction function is not significant which would imply that EU14 countries do not take into account the effective tax rates of NMS in setting their own effective tax rates. These results are in contrast to Devereux et al. (2008) who find no significant competition in STRs for OECD countries but they do find competition in effective tax rates. A possible reason for this difference is that they use a different method to calculate effective tax rates [20]. Moreover, we have observed (see Figure 4.3) that effective tax rates in Europe are quite stable. Tax reforms in Europe are characterized by decreasing tax rates, but an increasing taxable basis and thus stable effective tax rates. Taking first differences of the weighted effective tax rates will not show much variation. This may offer an explanation for the different results we find here.

[19] Redoano (2003) also did not find significant tax competition between economically similar (GDP per capita) EU13 countries

[20] They calculate the ETR by the method of Devereux et al. (2002). For a complete overview of ETR calculations see Nicodème (2001).

Table 3.3: Robustness Checks

dep var.=tax$_{EU14}$	(1)	(2) FON	(3) SON	(4) trade	(5) GDP	(6) etr
Tax$_{i,t-1}$	-0.04	-0.03	-0.02	-0.13	-0.09	-0.27***
	(0.1)	(0.08)	(0.08)	(0.13)	(0.21)	(0.09)
WTax$_{SI,SV,CZ,PO,HU,t}$	0.01**	0.04	0.05			
	(0.005)	(0.05)	(0.03)			
WTax$_{baltic,t}$	0.01	0.07	-0.06			
	(0.01)	(0.06)	(0.06)			
WTax$_{Ireland,t}$	49.05	0.01	0.03			
	(92.73)	(0.03)	(0.11)			
W$_{export_{ij,t}}$Tax$_{NMS,t}$				0.04**		
				(0.02)		
W$_{\frac{1/(GDP_{i,t}-GDP_{j,t})}{\sum_j 1/(GDP_{i,t}-GDP_{j,t})}}$ Tax$_{NMS,t}$					4.23	
					(3.75)	
W$_{distance}$ETR$_{NMS,t}$						-0.003
						(0.01)
Income tax$_{i,t-1}$	-0.02	-0.18	0.01	-0.09	-1.13	0.007
	(0.2)	(0.17)	(0.17)	(0.21)	(1.11)	(0.01)
GDP per capita$_{i,t}$	0.001**	0.001**	0.001*	0.002*		0.00003
	(0.001)	(0.001)	(0.001)	(0.001)		(0.00003)
Population density$_{i,t}$	0.13	0.02	0.06	0.07	0.96	-0.009
	(0.23)	(0.21)	(0.24)	(0.28)	(0.9)	(0.01)
Constant	-0.56	-0.95***	-0.89***	-0.4	2.86	-0.01
	(0.36)	(0.27)	(0.29)	(0.52)	(3.13)	(0.02)
Obs	156	156	156	104	143	144
Sargan test (p-value)	0.001	0.002	0.002	0.13	0.29	0.97

Standard errors are in parentheses. Column (1) splits $WTax_{NMS,t}$ up into smaller groups of countries and instruments with lags. Column (2) weights the taxes of NMS by a dummy equal to 1 if country i is an adjacent neighbor of a NMS, while column (3) uses a dummy equal to 1 if country i is a second order neighbor of a NMS. The weight in column (3) is the share of trade (export+import) from country i to the NMS in GDP of i. In column (4) the taxes of NMS are weighed with the distance in GDP per capita between both countries. Finally, column (5) uses the distance weighed effective tax rates (etr) of the NMS. All weighed variables, $WTax_{NMS,t}$ are instrumented with their lag. note:***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

3.8 Conclusion

During the past decade corporate tax rates decreased greatly in the 'old EU14. Especially, Germany and Italy experienced the largest decrease in their tax rates. Both countries are neighbors of the 'new' EU10. This chapter analyzes strategic tax setting in the 'old' EU14 as a reaction to the tax rates in the new member states. To our knowledge, this is the first chapter studying the impact of the new EU member states on tax rates of the old Europe.

A spatial competition model is developed to predict the role of distance in tax competition. The model predicts that tax competition is more intense between geographically close countries. This result has been empirically verified for the EU14 during the period 1993-2006 using a fiscal reaction function approach. Estimations show that only neighbors of the new member states seem to react to low taxes of these new members. Therefore, our theoretical propositions are confirmed. Moreover, we observe that neighbors of the new member states react far less to changes in the tax rate of other EU14 countries. To put it differently, the corporate tax rate of a country like Germany responds to changes in the tax rate of the new neighboring member states in the East like Czech Republic, but will respond much less to the tax rate in the West, say Belgium. When using other definitions of neighbors we only find weak spatial tax competition among trading partners.

The resulting spatial dimension of tax competition in this chapter will also have implications for transfer pricing. Since we find that neighbors of Eastern Europe are subject to more intense tax competition, tax differences between these countries will become smaller. As a consequence smaller tax differences are likely to induce less profit shifting towards Eastern Europe. In addition, smaller tax differentials will also stimulate decentralization choices of multinationals as pointed out by Nielsen et al. (2007).

3.9 Appendix A

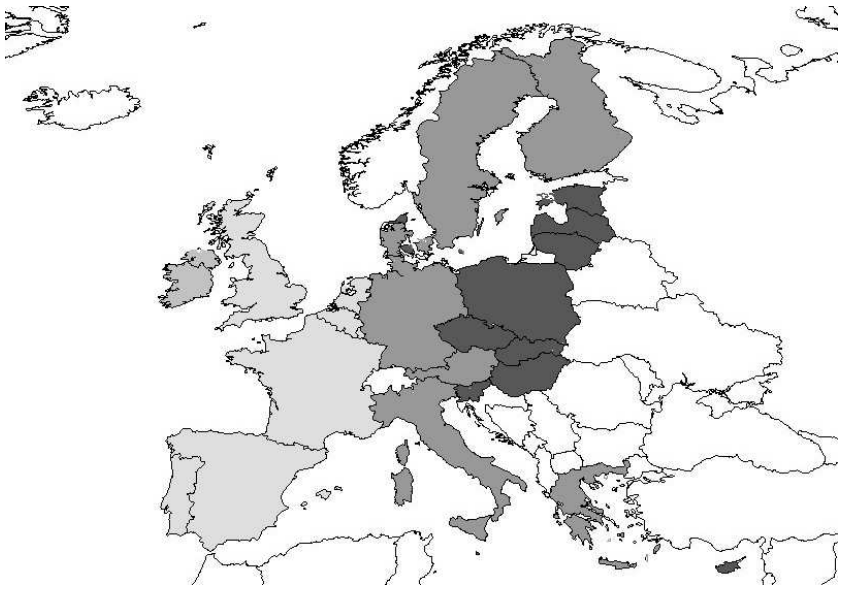

Figure 3.6: Map of EU25
New member states (EU10= black)= Estonia, Latvia, Lithuania, Poland, Hungary, Czech Republic, Slovakia and Slovenia
Neighbors of NMS (dark grey)= Sweden, Denmark, Germany, Austria, Italy and Greece
non-neighbors (light grey)= Netherlands, Belgium, France, UK, Spain and Portugal
Ireland (grey)

3.10 Appendix B

The computations of the model in section 3.4 in more detail:
The inverse demand functions are derived from:
$Q = M - bP$ where for simplicity is assumed that b=1. $\Rightarrow P_A = M - Q_A$ and $P_B = M - Q_B$.
Using these inverse demand functions, the after-tax profits in country A and B are respectively

$$\begin{aligned} \pi_A &= (M - Q_A)Q_A(1 - t_A) \\ \pi_B &= [(m - Q_B)Q_B + (M - Q_{AB})Q_{AB} - cx^2 Q_{AB}](1 - t_B) \end{aligned} \tag{3.21}$$

Maximizing the after-tax profits leads to the equilibrium output. The maximization is as follows
For A:

$$\begin{aligned} \frac{\partial \pi_A}{\partial Q_A} &= (1 - t_A)(M - Q_A - Q_A) = 0 \\ \Rightarrow Q_A^* &= \frac{M}{2} \\ &and \\ \frac{\delta \pi_A}{\delta Q_{AB}} &= (1 - t_A)((m - Q_{AB}) - Q_{AB} - cx) = 0 \\ \Rightarrow Q_{AB}^* &= \frac{m - cx}{2} \end{aligned} \tag{3.22}$$

For B:

$$\begin{aligned} \frac{\partial \pi_B}{\partial Q_B} &= (1 - t_B)(m - Q_B - Q_B) = 0 \\ \Rightarrow Q_B^* &= \frac{m}{2} \\ &and \\ \frac{\partial \pi_B}{\partial Q_{BA}} &= (1 - t_B)(m - Q_{BA} - Q_{BA} - cx) = 0 \\ \Rightarrow Q_{BA} &= \frac{M - cx}{2} \end{aligned} \tag{3.23}$$

Proof: $CS_1 > CS_2$

$$CS_1 = \int_0^{Q_A^*} (P_A dQ_A) - P_A Q_A^* = \frac{Q_A^2}{2} \tag{3.24}$$

$$CS_2 = \int_0^{Q_A^*} (P_A dQ_A) - P_A Q_A^* - cxQ_A = \frac{Q_A^2 - 2cxQ_A}{2}$$

$$\Rightarrow \frac{Q_A^2}{2} > \frac{Q_A^2 - 2cxQ_A}{2}$$

Proof: $\frac{\delta t_A^*}{\delta M} > 0$

$$\begin{aligned} \frac{\delta t_A^*}{\delta M} &= \frac{[2cx + t_B 2(M - cx)][M^2 + (m - cx)^2] - 2M(2cx(M - m))}{[M^2 + (m - cx)^2]^2} \\ &\quad \frac{-2M(t_B(m^2 + (M - cx)^2)}{[M^2 + (m - cx)^2]^2} \\ &= \frac{2(1 - t_B)cx[(m - cx)^2 + M(2m - M)]}{[M^2 + (m - cx)^2]^2} > 0 \end{aligned} \tag{3.25}$$

Table 3.4: First stage regression of benchmark regression in Table 3.1, column (4).

	$\Delta Tax_{i_{EU14},t-1}$	$\Delta W_{ij}Tax_{NMS,t}$
$\Delta popdensity_{i,t}$	.2	-0.17
	(0.2)	(0.13)
$\Delta gdp\ per\ capita_{i,t}$	0.0004	-0.001***
	(0.001)	(0.003)
$\Delta income\ tax_{i,t-1}$	0.4***	0.27***
	(0.16)	(0.1)
$\text{Tax}_{i,t-2}$	-0.09***	-0.04***
	(0.03)	(0.02)
$\Delta W_{ij} population > 14y_{j,t}$	-0.37	-0.83*
	(0.81)	(0.51)
$\Delta W_{ij} population\ density_{j,t}$	0.35	-0.07
	(0.33)	(0.21)
$\Delta W_{ij} active\ population_{j,t}$	-6.81E-09	-5.33E-08
	(7.5E-08)	(4.69E-08)
constant	2.34***	0.38
	(0.91)	(0.57)
Obs	156	156

Standard errors are in parentheses. note:***,** and * denote significance level of estimates at respectively 1, 5 and 10 percent levels.

Chapter 4

Trade Integration, Taxes, Institutions and Export Specialization

4.1 Introduction

During communism, trade amongst Central and Eastern European countries (CEECs) was centrally planned and international openness was low. The fall of the Berlin wall in 1989 led to the collapse of these artificial trade relations amongst Central and Eastern European countries. This event was the start of a long process during which Central and East European countries had to adapt their economic, political and institutional situation to the standards of a market economy. Trade flows rapidly reorientated to the EU. As a consequence, the EU15 became the main trade partner of Central and Eastern Europe. The process of trade integration between Central and Eastern Europe and the EU15 during the nineties offers us a unique opportunity to analyze the empirical relationship between trade integration and export specialization. Moreover, this chapter will explore whether lower effective tax rates (ETR) play a role in export specialization. It can be expected that if firms in particular sectors benefit from a tax advantage, the country will become more specialized in those sectors

[0]This chapter is based on co-authored work with M. Beine

and thus overall export specialization is going to increase. In addition, the institutional changes in Central and Eastern Europe allow to study the impact of two types of institutional reforms on export specialization. Note that this chapter is not a sectoral study, but will analyze the effects of trade integration, corporate effective tax rates and institutional reforms on export specialization in Central and Eastern Europe during the period 1989-2000.

Specialization of industries is an important issue because it makes countries more dependent on a few industries and thus increases the risk of a sector-specific shock (Koren & Tenreyro 2004). Since 12 of the 13 Central and East European countries in our sample became EU members in 2004 and 2007, their exposure to sector-specific shocks is of great interest to the EU15 as well. We observe gradually declining EU15 tariffs on Central and East European exports for the period 1989-2000. Over the same period, institutional reforms had increased rapidly. Two types of institutional reforms are analyzed: enterprise reforms and competition policy reforms. Enterprise reforms focus on credit and subsidy policies for firms and competition policy reforms. Both measures of institutional reforms are an indication of how well the countries perform in the restructuring of their policies and institutions from planned-economy to market-economy based standards. The average effective tax rate has decreased from 1997 onwards in Central Europe. This means that firms in general have been less taxed since 1997. A final observation is that the average export specialization in Central Europe is not a monotonic process. A Herfindhal index of export specialization in 13 former transition countries[1] is used as a proxy for industrial specialization. A higher value of the index refers to more export specialization, whereas a Herfindahl index closer to zero implies more export diversification. In the beginning of the nineties, export specialization increased sharply. After 1992, average exports in Central Europe diversified, while from 1997 onwards export specialization increased again. The aim of this chapter is to analyze whether trade integration and institutional reforms can explain the pattern of export specialization that we observe in the data. Using a dynamic panel model, the long- and short-run effects of changes in tariffs with the EU15

[1] Poland, Hungary, Czech Republic, Slovenia, Slovakia, Malta, Cyprus, Estonia, Latvia, Lithuania, Bulgaria, Romania and Turkey

on changes in export specialization in Central Europe can be disentangled. This is important because a shock in tariffs cannot be expected to have the same immediate and long-run effect on export specialization.

We find first that trade liberalization with the EU15 increases export specialization in Central Europe in the long-run. Second, institutional reforms stimulate export specialization as well. The results show that enterprise reforms such as restructuring credit, subsidy and bankruptcy policies towards more market-economy standards, increase the degree of export specialization significantly. An increase on the performance of enterprise reforms of 1 unit, increases export specialization by 28%. We did not find significant evidence on the role of corporate taxes which could be due to the nature of our tax measure. Also an indicator of corruption did not have a significant effect on export specialization.

The chapter is organized as follows. Section 4.2 reviews the related literature on the relationship between trade integration, taxes, institutions and export specialization and section 4.3 shows some stylized facts. Section 4.4 explains the methodology, while section 4.5 describes the data. Section 4.6 discusses the benchmark results and robustness checks. Finally, section 4.8 discusses the results and section 4.9 briefly concludes.

4.2 Related Literature

4.2.1 Trade Integration and Export Specialization

The first stream of literature that we discuss here argues that trade integration or trade liberalization stimulates a country to specialize in a given or a few sectors. Traditional trade theories have shown that trade liberalization results in increasing specialization in sectors where a country has a comparative advantage because of differences in technology or factor endowments between countries. Also new trade theories predict that countries specialize in sectors which are subject to economies of scale. Trade liberalization decreases the number of varieties of goods in a country to cut down on their average costs. According to the new economic geography theory, when trade costs decrease, firms will choose a location where they find a higher demand for their products and where they find the largest pool of

intermediate good producers. Proximity to suppliers and consumers reduces trade costs and may generate external economies of scale. As a consequence, regional specialization increases when trade costs are reduced (Amiti (1999), De Bruyne (2004) and Baldwin et al. (1999)).

The empirical literature provides evidence of increasing specialization in Western Europe ((Amiti 1999), (Brulhart 1998)) and Central and Eastern Europe. Traistaru et al. (2003) came to the conclusion that trade integration leads to higher regional specialization in five Eastern European countries[2] during the period 1990-1999. Similarly, the study by Hildebrandt & Wörz (2004) shows for 8 Central and Eastern European countries[3] greater industrial specialization during the period 1993-2000. One drawback of these studies is that usually trade integration is captured merely by a time trend assuming that trade integration is a linear process. In contrast, Trefler (2004) and Beine & Coulombe (2007) measure trade integration by tariffs. Trefler (2004) provides evidence that a free trade agreement (FTA) between the US and Canada leads to trade creation, increased labor productivity, but reduced employment for manufacturing workers in Canada. Beine & Coulombe (2007) suggest that trade liberalization between Canadian regions and the US resulted in more regional export specialization for Canada in the short-run, but less regional export specialization in the long-run. The authors suggest that better access to suppliers and customers or positive spillovers may trigger other industries to locate in the initially specialized region and induce diversification of economic activities in the long-run.

This study tests the impact of European integration of 13 Central and East European countries[4] on export specialization in Central and Eastern Europe[5]. Based on trade theory, we expect a positive relation between trade integration and export specialization. But given the transition economy history of the countries in the sample, we also need to take other elements into account as possible determinants of export specialization such as institu-

[2]Bulgaria, Romania, Hungary, Estonia and Slovenia

[3]Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovak Republic and Slovenia

[4]Poland, Hungary, Czech Republic, Slovenia, Slovakia, Malta, Cyprus, Estonia, Latvia, Lithuania, Bulgaria, Romania and Turkey

[5]In contrast Trefler (2004) and Beine & Coulombe (2007) studied export specialization between two industrialized countries.

tional reforms.

4.2.2 Corporate taxes and Export Specialization

In the literature, the effect of corporate taxes on export specialization has not been studied explicitly. Lambertini & Peri (2000) develop a model that shows how the government can use fiscal policy to promote specialization. They illustrate that the government can set a lower commodity tax for the sector they wish to specialize in. Although this model uses an industry specific sales tax, it can also apply to corporate taxes and sector-specific tax incentives. An empirical study by Devereux et al. (n.d.) observes that plants in the UK choose to locate near other plants of the same industry and new foreign-owned plants choose to locate near other foreign-owned plants within the same industry. But fiscal incentives in the form of government grants for new plants in areas with high unemployment slightly influence the location of firms.

Two related studies examined the effectiveness of R&D tax incentives. Hines (1999) analyzes the effect of the US treatment on the R&D activities of American multinationals. In the 1980s, American tax law changes reduced the tax deductions for R&D expenses. As a consequence, American multinationals were expected to increase their fraction of R&D in foreign locations. Hines (1999) observes that American multinationals responded significantly to the changes in R&D tax treatment, but moved only very few of their R&D activities to foreign centers. Bloom et al. (2002) investigate the responsiveness of R&D investment on tax changes in nine countries. They come to the conclusion that tax changes significantly affect the level of R&D in these countries.

From these studies we can conclude that taxes can influence sector and firm behavior. As a consequence, it is possible that corporate taxes influence export specialization as well.

4.2.3 Institutional Reforms and Export Specialization

In addition to the literature on trade integration, there is a growing literature on the importance of institutions for various measures of economic performance. For example, Acemoglu et al. (2005b) show that West-

ern countries with better access to the Atlantic ports had higher growth rates than Eastern European countries. They observed that countries with stronger political institutions, property rights and economic institutions traded more and spurred economic growth. In a more general framework, Acemoglu et al. (2005a) explain that good economic institutions create a stimulating environment for investors and producers. Therefore, institutions determine the economic outcome of a country. Also, Dollar & Kraay (2003) find that trade and institutions have an impact on growth, but only in the long run.

With regard to trade, Jansen & Nordas (2004) provide evidence that countries with better institutions trade more. Moreover, Francois & Manchin (2007) show that the infrastructure and institutional quality in a country matter more than tariffs in order to stimulate exports. We will study whether institutional reforms in a country have an impact on export specialization. Herefore, we will use two measures of institutional reforms: enterprise reforms and competition policy reforms which will be explained in more detail in section 4.5.4.

4.3 Stylized Facts

In this section, we document the trends of the main variables from our regression analysis in section 4.4.

4.3.1 Trade Integration

Under the centrally planned economy, Central and Eastern Europe had fixed prices, quantity and quality and a large shadow economy. Firms were stimulated to maximize output and employment instead of profits and efficiency. These incentives needed to be changed by transition reforms such as liberalization and privatization. This transition process started in 1989 and brought unexpected results. Together with price liberalization and privatization, output and employment decreased, inflation but also foreign direct investments increased (Roland 2000), (Walsh & Whelan 2001). In the pre-transition period, a centrally institution defined the bilateral trade relationships between countries. Transition caused almost a total collapse of

this trade. Central and East European firms needed to reorient trade and improve products (Rodrik 1994). Figure 4.1 shows that in 1989 most countries exported already intensively to Western Europe, but also to Russia. In 2000 the export share to Europe increased sharply, while the share of export to Russia decreased in all countries.

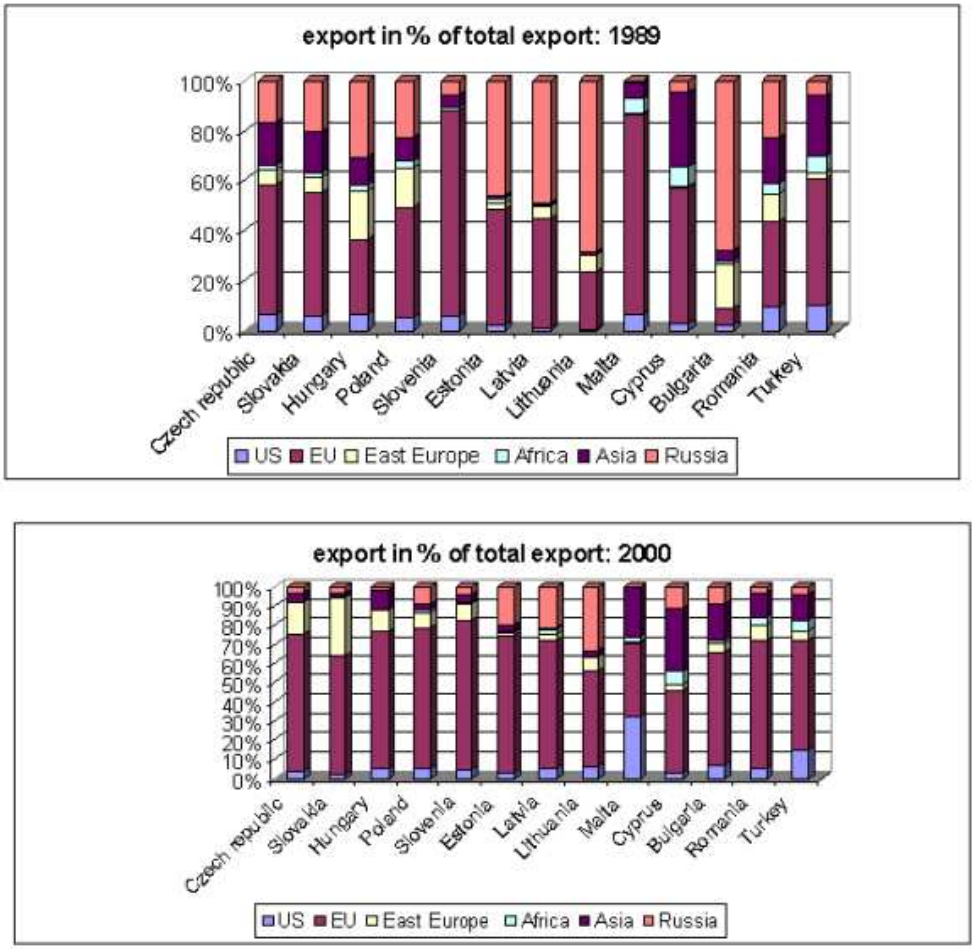

Figure 4.1: The shift of re-orientation to Europe (%), export share 1989-2000
Source: UN (1993, 1997, 2002)

Not only did Central Europe direct its exports more towards the European Union, but also the European Union allowed tariffs to decrease gradu-

ally during that period. Figure 4.2 plots the average unweighed tariff of the EU15 on imports from Central Europe over time. The average tariff started at an already relatively low level of 4.1% and declined gradually over the period 1989-2000 with two major drops in 1994 and 1997.

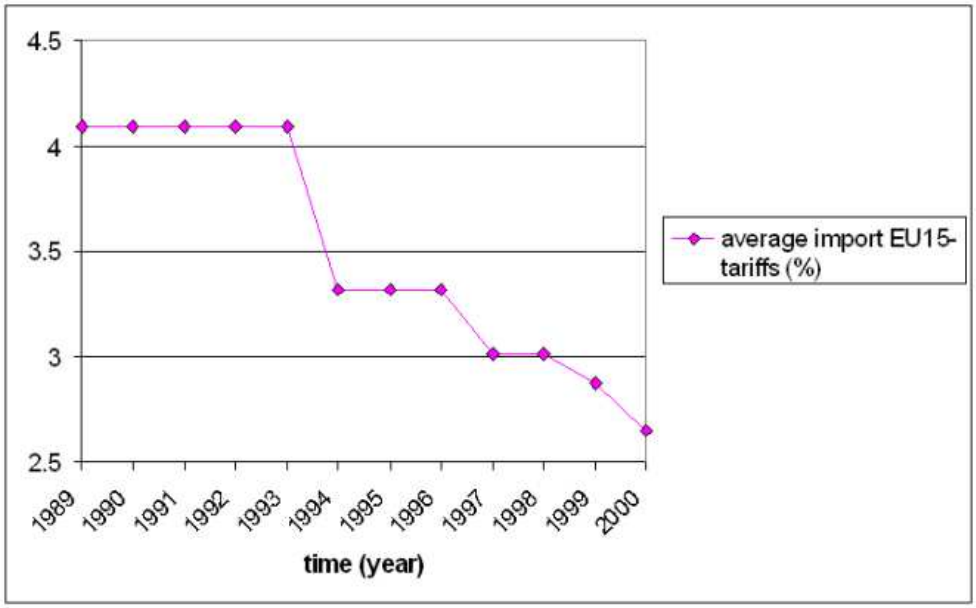

Figure 4.2: Trade liberalization of Central Europe with EU15 (%)
Source: Haveman data

By 1994 most countries[6] had signed a Europe agreement with the EU15 which was a bilateral agreement to decrease tariffs. These agreements might explain the first large decrease in tariffs in 1994 as illustrated in Figure 4.2. The second large tariff drop occurred between 1996-1997 and could be explained by the official start of the enlargement process in 1997-1998 when Central Europe adopted the European legislation. One of the chapters of this legislation deals with free movement of goods and establishing a free

[6]Poland and Hungary were the first to sign the Europe agreement in 1991, the Czech Republic, Bulgaria, Romania and Slovakia followed in 1993, Estonia, Latvia and Lithuania signed their Europe agreement in 1995 and finally in 1996 Slovenia signed the Europe agreement. Turkey, Malta and Cyprus signed the association agreement already in 1963, 1970 and 1972 respectively

trade area with the EU15. In May 2004, 10 countries became a EU-member[7], followed by Bulgaria and Romania in January 2007 so that capital, goods and services can be freely traded in the EU27. Turkey applied for member ship, but is not a EU member yet.

4.3.2 Corporate taxes

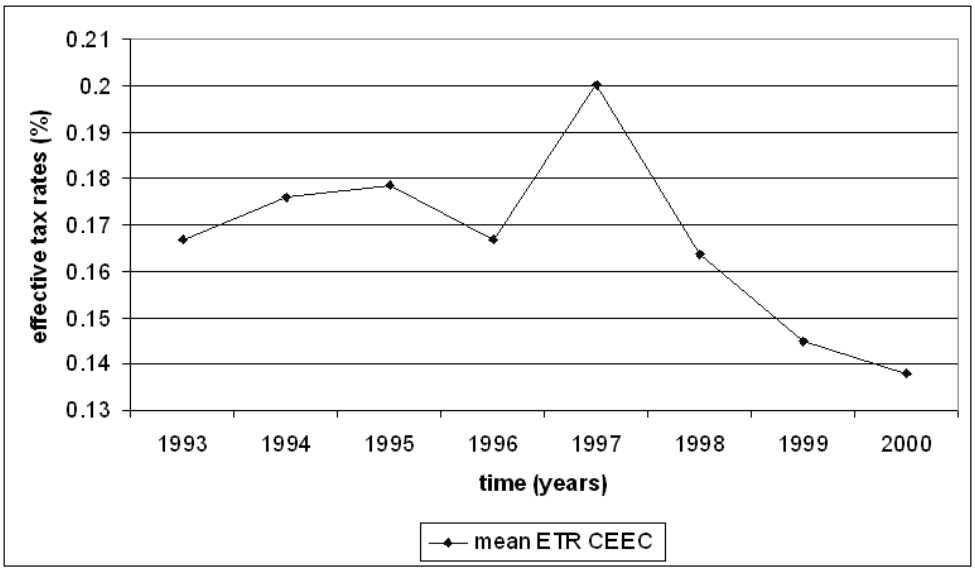

Figure 4.3: Average effective tax rates in Central Europe
Source: Amadeus data

Since governments might give tax incentives to certain sectors, the tax rate can also be a variable of interest in the regressions later on. The statutory tax rate does not take into account the tax base and tax incentives for specific companies or sectors. The tax base is the modified profit of a company whereon the tax rate is applied to calculate the amount of taxes the company should pay. Therefore, we prefer to use the effective tax rate (ETR) that does take into account the difference between a company's profit and the tax base (Vandenbussche et al. (2005) and Nicodème (2001)). Fig-

[7]Cyprus, Malta, Slovakia, Slovenia, Poland, Czech Republic, Hungary, Estonia, Latvia and Lithuania

ure 4.3 illustrates that during the late nineties, effective tax rates of firms in Central Europe increased until 1997, but decreased after 1997. This period of increasing effective tax rates, 1997-2000, coincides with the period of increasing export specialization in Figure 4.5. Hence, effective tax rates could matter for export specialization.

4.3.3 Institutional Reform

During the nineties, Central Europe made considerable reforms in institutions and policies. We use data on two measures for institutional reforms, namely enterprise reforms and competition policy reforms, to verify to what extent institutional reforms in addition to trade integration matter for export specialization. These variables, from the EBRD reports, indicate how well these countries perform on the restructuring from plan-economy to market-economy based institutions. The upper graph of Figure 4.4 suggests that during the period of our analysis, both types of institutional reforms have a clear positive trend. A second observation is that for the whole period, enterprise reforms were stronger than competition policy reforms and in addition the variable enterprise reforms shows more variation than competition policy reforms. During these eleven years, Central European countries increased from score 2 to almost score 3 for both institutional reforms. Since institutional reforms are only available for Central and Eastern European countries, a direct comparison with EU15 scores is not possible. In order to have some benchmark for these scores, we can compare the countries among each other according to their degree of development. The lower graph of Figure 4.4 illustrates that more developed countries in our sample [8] also have higher scores on both institutional reforms. Especially in the beginning of the period, the gap between countries with a high GDP per capita and countries with a low GDP per capita[9] is large. But from 1992 onwards, less developed countries catch up rapidly, while reforms in more developed countries remain stable.

[8] Countries with a GDP per capita above average: Czech Republic, Hungary and Slovenia.

[9] Countries with a GDP per capita below average: Bulgaria, Estonia, Latvia, Lithuania, Poland, Romania, Slovakia.

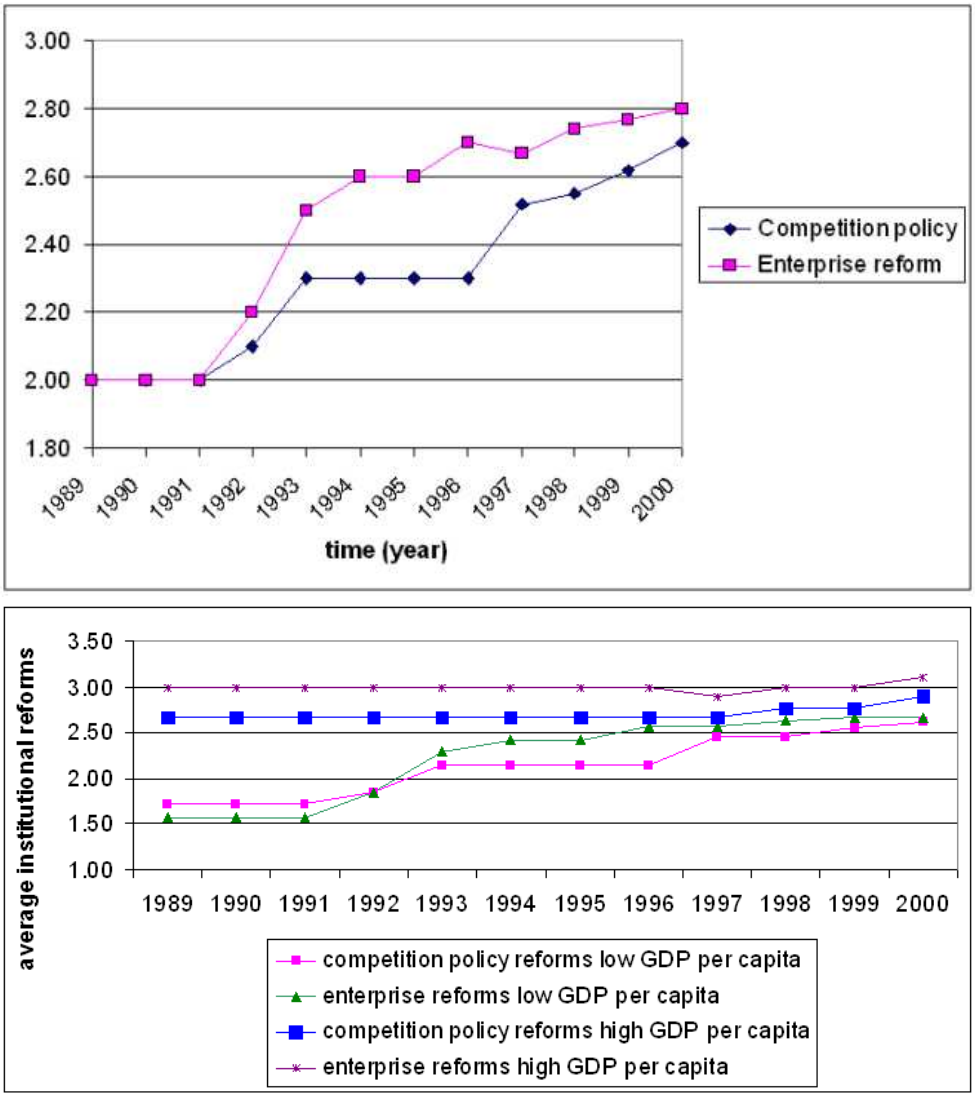

Figure 4.4: Average institutional reforms in Central Europe

Source: EBRD reports

4.3.4 Export Specialization

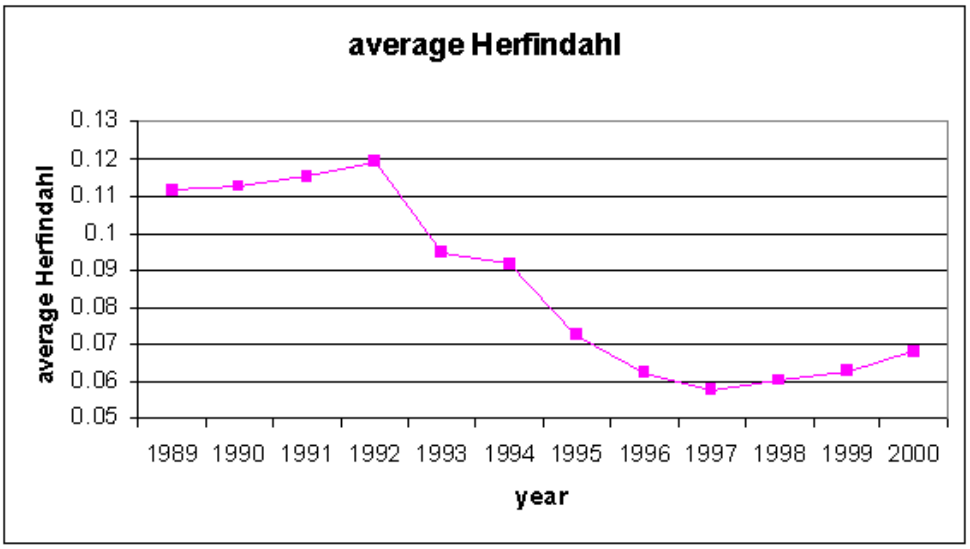

Figure 4.5: Average export specialization in Central Europe
Source: Eurostat

In Figure 4.5 we show the evolution of the average export specialization for 13 Central European countries during the period 1989-2000. As this will be our depended variable in the regression analysis, it is worth plotting it over time as we do in Figure 4.5. We measure export specialization by an Herfindahl index on exports which will be explained in more detail in section 4.5. The index lies between 0 and 1 and the interpretation is as follows: a higher value of the index refers to more export specialization, whereas a Herfindahl index closer to zero points out more export diversification. Figure 4.5 seems to indicate that export specialization in Central Europe is not a monotonic process. Since 1989, the start of transition, Eastern European countries needed to find their comparative advantage. Walsh & Whelan (2001) show that firms that produce EU oriented products outperform firms that sell products historically produced for the Eastern European market during the first 7 years of transition. The figure illustrates that in the early nineties average export specialization increased sharply, probably because countries redirected their exports after transition. After 1992, export

specialization decreased which could indicate that Central Europe started exporting in more and new sectors. While after 1997, export specialization has increased again, suggesting that the number of sectors the countries are exporting in, went down. This U-shape is also what Imbs & Wacziarg (2003) and Koren & Tenreyro (2004) found for other countries: sectoral concentration is a function of the level of per capita income. Poor countries tend to diversify to reduce the risk of a sector specific shock, when they grow to higher levels of per capita income they specialize again but never as high again as their initial specialization level. But a similar value of the export specialization index at different moments in time may hide a different sector specialization. It might be that the export mix has changed over time. We will add a short discussion on this in section 4.8.

Note that figure 4.5 illustrates the average export specialization for all 13 countries. Nevertheless, there are differences across countries. The individual evolution of the countries' export specialization is illustrated in Appendix 4.10. From these figures we observe that export specialization increased in the most recent years, except for Slovenia, Lithuania, Malta and Romania.

4.4 Methodology

In order to investigate the relationship between trade integration, institutions and export specialization, we build on the approach proposed by Beine & Coulombe (2007) which relies on the estimation of a dynamic panel model which is derived from an error correction model (See appendix, Vogelvang (2005)). The estimation model is as follows

$$\begin{aligned}\Delta log(Exp\ spec._{i,t}) = \alpha_i + \delta_t + \phi_1 log(Exp\ spec._{i,t-1}) + \phi_2 \Delta log(tariff_{EU15i,t}) \\ + \phi_3 log(tariff_{EU15i,t-1}) + \phi_4 I_{i,t} + \phi_5 ETR_{i,t} \phi_6' Z_{i,t} + \epsilon_{i,t}\end{aligned} \tag{4.1}$$

where i is a Central or East European country in a certain year t. $Exp\ spec._{i,t}$ is export specialization measured by a Herfindahl index based on annual sectoral trade flows from Central Europe to the EU15. $Tariff_{EU15i,t}$ is the EU15-tariff on exports from a Central and Eastern European country i. This measure is based on sectoral tariffs, weighted with the export

structure of country i and aggregated to the country level. ETR is the effective tax rate of country i. $I_{i,t}$ captures the level of a country's institutional reforms, $ETR_{i,t}$ is the effective tax rate and $Z_{i,t}$ is a vector of other control variables such as business cycles. Country fixed effects, α_i, control for unobserved country-specific effects and δ_t are time dummies controlling for a common shock and $\epsilon_{i,t}$ is the error term. The definition of the variables will be clarified in more detail in section 4.5. This model is estimated with OLS[10] and Newey-West robust standard errors to take into account serial correlation and heteroscedasticity.

The dynamic nature of the model is important because it disentangles the short-run from the long-run effects of trade integration. The short-run is captured by ϕ_3 while the long run is given by $-\frac{\phi_2}{\phi_1}$. The decomposition of the effect of trade integration between a short- and a long-run component is important since a shock in tariffs will lead to short-run adjustment costs (displaced workers, closed plants), while in the long-run, trade liberalization will lead to efficiency gains (stakeholders of competitive plants and users of final and intermediate goods) (Trefler, 2004). The derivation of the short- and long-run effect of this model is explained in Appendix E (Vogelvang 2005).

4.5 Data

In equation (4.1) the degree of export specialization (Exp spec.) is a function of trade weighted tariffs (tariff), effective tax rate (ETR), institutional reforms (I) and other control variables (Z) such as the business cycles. This section gives an overview of the data and variables.

4.5.1 Export Specialization

A common measure for export specialization in the literature is the Herfindahl index on exports (Sapir 1996)[11]. The evolution of the Herfindahl

[10] GMM will be used as a robustness check. However, since the time series are short, the number of instruments are limited to two lags.

[11] We investigate here the degree of the so-called absolute specialization, i.e. the extent to what a given country or region is specialized in a limited number of activities. This concept

index of export specialization might reveal to what extent a given country is becoming more specialized or diversified, regardless of how the economic structures of other countries are evolving. A recent study has shown that export specialization is a good proxy for industrial specialization (Laurin 2007).

The Herfindahl index is computed for each country i and each year t as the sum of squared export shares over all industries within one country.

$$Exp.\ spec._{i,t} = \sum_{k=1}^{J} (s_{i,t}^{k})^2 \tag{4.2}$$

$$where\ s_{i,t}^{k} = exports_{i,t}^{k} / \sum_{k=1}^{J} exports_{i,t}^{k}$$

A higher index indicates that country i exports in a smaller range of sectors and hence is more specialized. To construct the Herfindahl indices, yearly export flows from 13 individual countries of Central and Eastern Europe to the European Union on the 8-digit HS classification[12] product level were collected from *Eurostat*[13]for the period 1989-2000[14][15]. Using a correspondence key, the data was translated to the 4-digit NACE industry level[16] (250 sectors). Note that we study only trade flows to and tariffs from the EU15. Since the EU15 is the main trading partner of the Central and East European countries as illustrated in Figure 4.1, EU15-tariffs will have the largest effect on export specialization in Central Europe and tariffs of the rest of the world will not play a major role in our results.

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of specialization directly relates to the concept of risk exposure. This contrasts with relative specialization which measures to what extent the export or production structure differs from those of the other (contingent) countries or regions.

[12]The Harmonized system (HS) is a classification system we use at the 8-digit product level

[13]The Eurostat trade statistics is a high quality database containing annual data on trade flows to and from Central and East European countries.

[14]For Estonia, Latvia, Lithuania and Slovenia data was available from 1992 onwards and for Slovakia from 1993 onwards.

[15]Note that we collected trade data for all sectors, not only the manufacturing sector

[16]NACE is a European classification system.

4.5.2 Trade Integration

Most previous studies on trade integration use time dummies to capture trade integration and thereby implicitly assume that trade integration is linear over time. From Figure 4.5 we know that trade integration is not linear, therefore we rather use tariffs to measure trade integration as in Beine & Coulombe (2007) and Trefler (2004). Yearly EU15-tariffs[17] on the HS 8-digit product level are collected from the *Haveman database*. These data are available from 1989 until 2000. Since not all tariffs were available for all years[18], we replaced the missing tariff at time t with the tariff value at $t+1$[19].

The sectoral EU15-tariffs τ^k on exports from Central and East European countries are aggregated to the country level using the export share of the industry in total export of the country as weights w_i^k:

$$tariff_{EU15i,t} = \sum_{k=1}^{J} w_{i,t}^k \tau_t^k \tag{4.3}$$

$$with\ weight\ w_i^k = exports_k^i / \sum_{k=1}^{J} exports_k^i$$

To test the robustness of this trade weighted tariff, regressions with different weights and two alternative measures for tariffs will be used in the estimations in section 4.6.

4.5.3 Corporate taxes

Since the nominal corporate tax rate does not take into account tax deductions for specific investments, this analysis will include the effective tax rate. The effective tax rate is a ratio of corporate taxes and profit before

[17] Only the preferential rates on export products from an individual Central and Eastern European country was used, but when this rate was not available, we used the MFN (most favored nations) rates.

[18] Only the years 1996, 1998, 1999 and 2000 were available for most products.

[19] Estimations where we replaced the missing tariff at time t with the tariff value of time $t-1$ did not change results

tax collected from company accounts for 12 Central European countries[20] (Vandenbussche et al. 2005), (Buijink et al. 2000) and (Nicodème 2001). This data is used to calculate the average effective tax rates per country.

$$ETR_{i,t} = \frac{\sum ETR_{firm,t}}{number\ of\ firms} \tag{4.4}$$

4.5.4 Institutional reforms

The transition process also implied a drastic institutional change in Central Europe. Institutions were reformed towards more market economy standards. We will use two indicators of institutional reforms: enterprise reforms and competition policy reforms from the *EBRD* [21]. These transition indicators reflect the judgment of the EBRD about country-specific progress in enterprise and competition policy reforms. EBRD Country specialists propose a score for a particular country which is then discussed at length by an internal committee within the EBRD. Each country gets a score between 1 and 4.33[22] where 1 represents an institution with little or no change from a centrally planned market and 4.33 indicates that the standards of an industrialized market economy are implemented in the institutional environment of the country. To assign these scores, the EBRD follows certain criteria for each institution based on the following classification system in Table 4.1.

The enterprise reforms indicate to what extent the countries reduced production subsidies and introduced effective bankruptcy procedures to be more in line with market-economy standards. A country has a score of 1 if there is no financial discipline at the enterprise level, this means that inefficient firms receive generous state subsidies to continue production. When effective bankruptcy procedures exist and credits are given to the most efficient firms, the country will receive a score of 4.33. The competition policy reforms indicator concentrates on facilitating market entry and combating the abuse of market dominance by monopolies. A score of 1 indicates that

[20] The tax and profit data for Turkey was not sufficient available in Amadeus to calculate the effective tax rate.

[21] EBRD is the European Bank for Reconstruction and Development

[22] The scores increment with 0.33, this means that the scale between, say 2 and 3, would have the following components: 2;2.33;2.66 and 3

Table 4.1: Institutional reforms

score	enterprise reforms
1	if there are soft budget constraints (lax credit and subsidy policies weakening financial discipline at the enterprise level) and few other reforms are made to promote corporate governance.
2	if there is a moderately tight credit and subsidy policy, but weak enforcement of bankruptcy legislation and little action taken to strengthen competition and corporate governance.
3	if significant and sustained actions are taken to harden budget constraints (tight credit and subsidy policy) and to promote corporate governance effectively.
4	if substantial improvement is made in corporate governance and significant new investment at the enterprise level.
4.33	if there are standards and performance typical of advanced industrial economies: effective corporate control exercised through domestic financial institutions and markets, fostering market-driven restructuring.
score	competition policy reforms
1	if there are no competition legislation and institutions.
2	if competition legislation and institutions are set up and there is some reduction of entry restrictions or enforcement action on dominant firms.
3	if some enforcement actions are taken to reduce abuse of market power and to promote a competitive environment.
4	if significant enforcement actions are taken to reduce abuse of market power and to promote a competitive environment.
4.33	if there are standards and performance norms typical of advanced industrial economies: effective enforcement of competition policy; unrestricted entry to most markets.

Source: EBRD reports

Note: the EBRD indicators are not available for Malta, Cyprus and Turkey.

there is no competition legislation, a few dominant firms control the market and market entry is restricted. When a country achieves effective enforcement of competition policy, meaning unrestricted entry to the market and punishment of abuse of market power, a score of 4.33 is given. A disadvantage of these indicators is that for some countries the variable does not vary much over time. A detailed table on this data is reported in Appendix C.

A final remark should be made on corruption. According to Dixit (2004), deficiencies of the law are especially present in less developed countries and in transition countries. The collapse of a strict communist system and the transition to a market economy left some areas open for groups to provide alternative institutions and economic rules. Therefore, it is important to what extent these institutional variables take into account corruption. A corruption index is collected from 'transparency international network'. This index assesses the level at which corruption is perceived by businessman as impacting on commercial life. The index is based on several surveys in a list of countries and lies between 0 and 10. A score of 10 equals an entirely clean country, while 0 equals a country where business transactions are entirely dominated by extortion. In other words, a higher index equals less corruption perceived by businessmen in that country. Figure 4.6 illustrates that this corruption index is positively correlated with enterprise reforms. A country with more advanced enterprise reforms has also less corruption. This suggests that the level of corruption is possibly already taken into account in the institutional reforms measure.

4.5.5 Other control Variables

First, to control for business cycles in individual Central and East European countries and the EU15, GDP data (*EBRD reports, IMF database*) are decomposed in a growth trend and a cyclical component, the business cycle, with the Hodrick-Prescott filter.[23]

Second, the economic freedom index reports an index for hidden import

[23]Maravall & del Rio (2001) and Pedersen (2001) suggest that the smoothing parameter of the filter should be between 6 and 14 for annual data. Higher values produce smoother results. In this analysis, we will use a value of 7 for the smoothing parameter. Results with a smooth value of 14 are not reported here, but are similar.

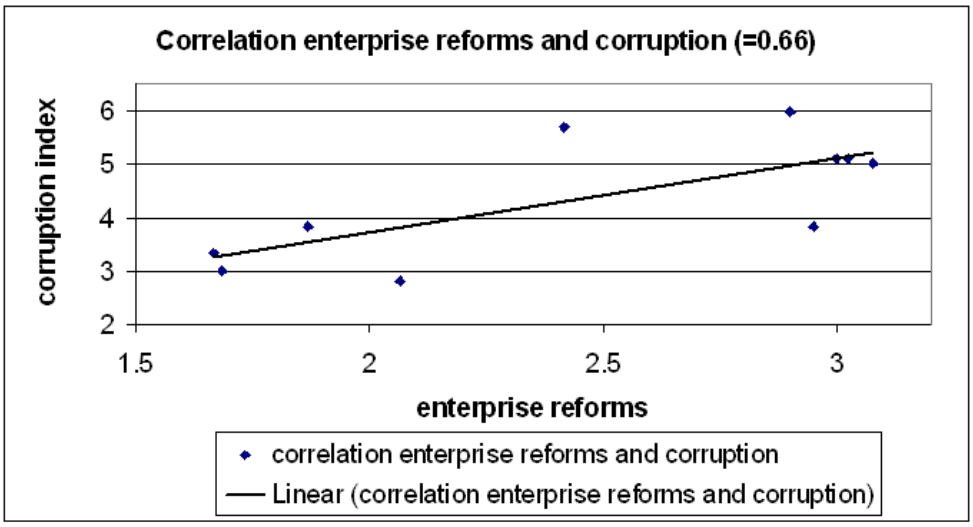


Figure 4.6: Correlation enterprise reforms and corruption in Central Europe
Source: EBRD reports and transparency international network

barriers (HIB) other than published tariffs and quotas[24]. Since correlation between the hidden import barriers index and our variable for trade weighted tariffs is low (correlation = 0.0136), this variable can be included complementary to the tariff variable. This will allow us to control for other tariffs, non-tariff barriers or quotas that are not captured by the tariff variable.

Final, two alternatives for the tariff variable will be used to measure trade integration with the EU15. An indicator of trade liberalization from the EBRD data will indicate to what extent there are no import or export restrictions. The indicator of price liberalization from the EBRD data will show to what extent there are no price restrictions in the country.

4.6 Results

Table 4.2 reports the main estimation results of our benchmark regression as in specification (4.1). Column (1) shows the results of a regression with tariffs, control variables for the business cycle, country and time fixed

[24]HIB is only available for the years 1990, 1995 and 2000 on a country-level

effects. Since year dummies are not significant and do not change the result, they will not be included anymore in the following regressions[25]. Regressions (2) and (3) report the institutional reforms variables, enterprise reforms and competition policy reforms, separately[26] and reduce the analysis to 10 countries since the institutional reforms variables are not available for Malta, Cyprus and Turkey. According to Acemoglu et al. (2005a) institutions influence a country's economic performance, but economic performance will change the political power of groups in a society and thus change institutions. Therefore, institutions can be endogenous. The regression in column (4) instruments the variable enterprise reforms variables with its lag to control for possible endogeneity. The regressions (5) and (6) include the effective tax rate (etr) of the country. Although the Hausman test did not find endogeneity for the effective tax rate, intuitively it is possible that the effective tax rate is a function of export specialization. For a country specialized in a certain sector, the government can decide to allow sector-specific tax credits to stimulate the production in this sector even more. Therefore, column (6) instruments the effective tax rates by its lag and the official tax rate to control for this possible endogeneity.

We find very robust results in favor of a long-run relationship between trade integration and export specialization $(-\phi_2/\phi_1)$[27]. The long-run relationship is negative, based at Table 4.2, column (2), a 1% decrease in EU15-tariffs increases export specialization in Central Europe by 1.3%[28]. This result supports trade theories suggesting that trade integration leads to a long-run concentration of activities across regions and across sectors. In the short-run, trade integration has no significant influence on export specialization (coefficient ϕ_3 is not significant). The lagged dependent variable, log(export specialization$_{t-1}$), is negative significant suggesting that there is

[25]This is important because it suggests that our results are not driven by time trends common to all countries.

[26]The correlation (0.72) between the enterprise reforms and competition policy reforms variables is too high to include these variables in 1 regression.

[27]Using a Wald test, the ratio $(-\phi_2/\phi_1)$ is significantly different from zero (p-value = 0.0006).

[28]Estimations with more lags of the tariff and export specialization variables did not change results and were not significant. Therefore, these estimations are not reported here.

Table 4.2: Main regression results

	(1)	(2)	(3)	(4) IV	(5)	(6) IV
$Constant$	-1.4***	-0.74*	-1.02*	-0.71	-1.8***	-1.34*
	(0.47)	(0.44)	(0.55)	(0.45)	(0.48)	(0.8)
$log(Exp\ spec._{i,t-1})$	**-0.41*** **	**-0.44*** **	**-0.39*** **	**-0.4*** **	**-0.42*** **	**-0.6*** **
	(0.08)	(0.08)	(0.08)	(0.09)	(0.08)	(0.17)
$log(tariff_{i,t-1})$	**-0.49*** **	**-0.58** **	**-0.23**	**-0.27**	**-0.47*** **	**-0.54***
	(0.15)	(0.28)	(0.25)	(0.29)	(0.17)	(0.29)
$\Delta log(tariff_{i,t})$	-0.21*	-0.13	-0.14	-0.15	-0.16	-0.2
	(0.12)	(0.11)	(0.10)	(0.15)	(0.10)	(0.18)
nat. bus. cycle$_{it}$	1.47e-6	6.17e-7	-8.21e-7	9.26e-7	1.54E-6	1.8E-6
	(1.74e-6)	(1.38e-6)	(1.80e-6)	(2.24e-6)	(1.83E-6)	(2.87E-6)
EU bus. cycle$_{it}$	0.001***	-0.0001	-.0001	0.0002	0.002***	0.002***
	(.0006)	(0.0005)	(.0005)	(0.001)	(0.001)	(0.001)
enterprise reform$_{it}$	-	**0.28*** **	-	0.04	-	-
		(0.10)		(0.17)		
competition policy$_{it}$	-	-	**0.15**	-	-	-
			(0.09)			
etr	-	-	-	-	0.32	-4.89
					(0.43)	(3.28)
time dum.	**yes**	-	-	-	-	-
country fix. eff.	yes	yes	yes	yes	yes	yes
obs	121	91	91	91	101	91
$F(pvalue)$	0.00	0.00	0.00	0.004	0.00	0.00
R^2	0.40	0.4	0.35	0.23	0.41	0.51
Sargan (p-values)				/		0.04

Robust standard errors of estimates are in parentheses. Time dummies are only included in regression (1). Regression (2) and regression (3) only take into account 10 countries since data on institutional reforms was not available for Malta, Cyprus and Turkey. In column (4) IV is used: enterprise reform is instrumented by the lagged value. In column (5) the regression includes the average effective tax rate per country and in column (6) this variable is instrumented by the lag of the average effective tax rate. note:***, ** and * denote significance level of estimates at respectively 10, 5 and 1 percent levels.

no persistence in export specialization. A possible explanation for this observation is that export specialization is decreasing in the first years of the sample period (see Figure 4.5).

Regarding the institutional reforms, the estimation results of Table 4.2 indicate that enterprise reforms have a positive and significant effect on export specialization. This implies that an increase of one unit in enterprise reforms, leads to an increase of 28% in export specialization. In contrast, competition policy reforms have no significant effect on export specialization. A possible explanation is that competition policy can influence the volume of trade or exports, but does not influence export specialization in itself. Moreover, stricter credit policies may imply that the least efficient firms will exit the market and only firms in the most productive sectors will survive. So that export will be concentrated in sectors with a comparative advantage. The last column of Table 4.2 lags enterprise reforms with one period to overcome possible endogeneity. The coefficient of enterprise reforms is still positive, but not significant. Also effective tax rates do not affect export specialization significantly. A possible reason is that our measure of effective tax rates is too aggregated to capture to what extent specific sectors receive tax credits. The long-run effect of tariffs on export specialization still holds.

Our study confirms the result of increasing specialization in Central Europe of previous studies using time dummies to measure trade integration (Hildebrandt & Wörz (2004) and Traistaru et al. (2003)). Moreover, we extend their result to 13 countries in Central Europe and identify the main drivers behind export specialization: trade integration and enterprise reforms. A possible explanation why we find the opposite result of Beine & Coulombe (2007) for Canada is the difference in the level of development of the sample countries (Imbs & Wacziarg (2003), Koren & Tenreyro (2004)).

4.7 Robustness checks

In order to assess the robustness of our regression results in Table 4.2, this section will report some extended analyses.

The regressions in columns (1) and (2) in Table 4.3 deal with possible econometric problems. First, since the weights of the tariff variable could

be endogenously correlated with the Herfindahl index of exports, regression (1) uses constant weights (average export share over the period 1989-2000) in the tariff variable. The disadvantage of this constant weight is the loss of variation over time. Therefore, column (2) uses the weight of the tariff variable lagged by 1 period. We also need to consider the possibility of non-linearities in export specialization. From Figure 4.5 we know that export specialization does not follow a monotonic pattern. Therefore, column (3) controls for a non-linear relationship between tariffs and export specialization. Since corruption was especially a big problem during transition in Central Europe, column (4) explicitly controls for corruption. Finally, regression (5) includes a measure for non published import tariffs and quotas (HIB).

The long-run effect of tariffs on export specialization still holds in columns (1)-(3). Moreover, in column (3) a non-linear effect of tariffs is positive, but not significant. A positive non-linear effect would imply that a small decrease in tariffs at higher tariff levels, decreases export specialization. This could be the case for prohibitive tariffs. A decrease in a prohibitive tariff will lead to more firms exporting in different sectors and thus induce export diversification. Moreover, the maximum unweighted import tariff in our sample is only 5.96%.

Another robustness check explicitly controls for corruption. The estimation in column (4) shows that the corruption index is not significant. Finally, controlling for other tariffs (HIB) does not change previous results, the estimation in column (5) implies that the tariff variable captures most of the trade integration process between Central and Eastern Europe and the EU15[29].

Table 4.4 reports a second set of robustness checks. First, the sample is reduced to the period 1994-2000 in column (1). This robustness check excludes influences from a possible prohibitive tariff in the beginning of transition and the heavily restructuring period in the first years of transition. In Column (2), the regression is only estimated for the EU10 to test whether Turkey, Bulgaria and Romania, who have a different EU-accession path,

[29]Other authors tried to proxy non-tariff barriers by a frequency index but failed to find a significant influence on trade (Amiti & Konings (2007) and Mayer & Zignago (2005)).

Table 4.3: Impact on export specialization for Central Europe

	(1)	(2)	(3)	(4)	(5)
$Constant$	-0.84*	-0.4	-1.09***	-0.53	-0.96
	(0.51)	(0.64)	(0.44)	(0.52)	(6.65)
$log(Exp\ spec._{i,t-1})$	**-0.35*** **	**-0.56*** **	**-0.43*** **	**-0.40*** **	**-0.45*** **
	(0.07)	(0.1)	(0.08)	(0.08)	(0.08)
$log(tariff_{i,t-1})$	**-0.41*** **	**-0.84*** **	**-0.58*** **	**-0.12**	**-0.54*** **
	(0.16)	(0.33)	(0.16)	(0.26)	(0.16)
$\Delta log(tariff_{i,t})$	0.13	-0.04	-0.42*	-0.11	-0.18
	(0.18)	(0.08)	(0.23)	(0.08)	(0.12)
nat. business cycle$_{it}$	-1.64e-07	4.12e-06	1.78e-06	9e-07	1.72e-06
	(1.31e-06)	(2.80e-06)	(1.66e-06)	(1.39e-06)	(1.90e-06)
EU business cycle$_{it}$	.0006	-0.0003	0.001**	-0.0003	0.001
	(.0005)	(0.0004)	(0.0005)	(0.0005)	(0.001)
$\Delta log(tariff^2_{i,t})$	-	-	0.23	-	
			(0.17)		
corruption$_{it}$	-	-	-	-0.09	
				(0.07)	
HIB$_{it}$	-	-	-	-	**-0.04**
					(0.87)
country fixed effects	yes	yes	yes	yes	yes
obs	121	81	121	90	114
$p\ value(F-stat)$	0.00	0.00	0.00	0.00	0.00
R^2	0.58	0.46	0.38	0.41	0.38

Robust standard errors of estimates are in parentheses. All models include country fixed effects. In column (1) the regression uses constant export shares as weights for the tariff variable and in column (2) the weights of the tariff variable are lagged by 1 period. Regression (3) takes into account a non linear effect of tariffs on export specialization. A variable to control for corruption or for other barriers (HIB) is included in column (4) and (5) respectively. note:***, ** and * denote significance level of estimates at respectively 10, 5 and 1 percent levels.

influenced the results. The results in Table 4.4 show that the long-run effect of tariffs on export specialization holds in both cases.

Finally, Table 4.4 verifies whether our results are robust to different measures of trade integration and export specialization. In column (3) and (4), the tariff variable is replaced by an index of trade liberalization and an index of price liberalization respectively, both variables show up positive and significant in the regressions. This confirms that more trade or price liberalization leads to more export specialization. In column (5) an alternative measure for export specialization is used instead of the Herfindahl index of export specialization. Using this alternative measure of export specialization, the long run effect of tariffs still holds and even the short run effect of tariffs is negative and significant. This confirms that trade integration has led to more export specialization in Central and Eastern Europe during the period 1989-2000.

4.8 Discussion of results

A recent study by Francois & Manchin (2007) examines the role of institutions, infrastructure and tariffs in explaining why some countries trade and others do not. The authors show that basic infrastructure (communications and transport) and institutional quality matter more for exports than tariffs. Our results showed that a decrease in EU15 tariffs by 1% induces an increase in export specialization by 1.3%, while an increase of one unit of enterprise reforms leads to an increase in export specialization by 28%. A wald test could not counter the null hypothesis that the coefficient of the long-run effect of tariffs and the coefficient of enterprise reforms are equal. This suggests that both tariffs and enterprise reforms play a similar important role in stimulating export specialization in Central and Eastern Europe although the tariff effect is more robust.

Figure 4.5 in section 4.3 showed that export specialization in Central Europe decreased until 1997 and then increased again. But this does not necessarily mean that Central Europe specialized in the same sectors in 2000 than in 1989. In this discussion we would like to analyze how much of the specialization in 2000 is associated with a change in the composition of total

Table 4.4: Robustness check

	(1)	(2)	(3)	(4)
$Constant$	-1.56**	-0.98**	-1.17***	-1.18***
	(0.67)	(0.5)	(0.42)	(0.37)
$log(Exp\ spec._{i,t-1})$	**-0.47*** **	**-0.45*** **	**-0.36*** **	**-0.38*** **
	(0.1)	(0.09)	(0.09)	(0.09)
$log(tariff_{i,t-1})$	**-0.55****	**-0.63*** **		-
	(0.26)	(0.17)		
$\Delta log(tariff_{i,t})$	-0.19*	-0.21*	-	-
	(0.11)	(0.13)		
nat. bus. $cycle_{it}$	-9.64e-07	5.25e-06***	5.36e-07	7.99e-07
	(2.19e-06)	(1.69e-06)	(1.29e-06)	(1.28e-06)
EU bus. $cycle_{it}$	0.002*	0.002***	-0.0004	-0.0005
	(0.0008)	(0.001)	(0.0004)	(0.0004)
trade $liberal._{it}$	-	-	**0.09***	-
			(0.05)	
price $liberal._{it}$	-	-	-	**0.12*** **
				(0.05)
country f. e.	yes	yes	yes	yes
obs	87	88	91	91
$p\ value(F-stat)$	0.00	0.00	0.00	0.00
R^2	0.41	0.41	0.58	0.37

Robust standard errors of estimates are in parentheses. Regression (1) does not include the years 1989-1993, while regression (2) uses only the EU10 (not Turkey, Bulgaria and Romania). Regressions in column (3) and (4) replace the tariff variable by an indicator of trade and price liberalization respectively. note: ***, ** and * denote significance level of estimates at respectively 10, 5 and 1 percent levels.

exports. Therefore we follow Hoekman & Djankov (1997) who measure the change in the composition of exports by calculating the simple correlation between RCAs[30] for each country in 1990 and 1995. A higher correlation indicates that less change has occurred. Hoekman & Djankov (1997) observe little change in the composition of exports. Most countries of Central Europe exported in the same sectors in 1995 as in 1990. We will extend their analysis with our export data from 1989 until 2000. The correlations between the RCAs for each country in 1989 and 2000 is reported in Table 4.5. The correlations are remarkably lower than in Hoekman & Djankov (1997) which might be indicative of a change in the composition of exports of Central Europe in 2000. To gain insight in which sectors the Central European countries are specialized, Figures 4.7 to 4.9 compare the export share in the manufacturing, agriculture and mining sector for each country in 1989 and 2000. The figures show that all countries except Latvia[31] increased their export share in the manufacturing sector, at the expense of exports in the agriculture and mining sector. Within the manufacturing sector especially exports in the transport, metals, electrical and textiles sector increased sharply (See figures in Appendix for an overview per country). According to Sinn (2006) more and more Western European firms have their products prefabricated abroad. By setting up their own manufacturing plants in Eastern Europe (offshoring), they make use of the low wages in this region. While labor intensive upstream activities are shifted abroad, the downstream stages of production remain in Western Europe and are even expanded. A first glance on one of the expanding sectors in Central Europe, the textiles sector, shows us that indeed Central Europe is mainly exporting in labor-intensive sectors as preparation of textile fibres, textile weaving and manufacturing of knitted pullovers.

A final issue to be discussed is whether tariffs decreased for all sectors.

[30]RCA is the revealed comparative advantage index and measures as:

$$(\frac{x_{ij}}{X_j})/(\frac{\sum_{i=1}^{N} x_{ij}}{\sum_{j=1}^{N} X_j}) \tag{4.5}$$

where x_{ij} are exports in sector i by country j, X_j are country j's total exports, N is the number of countries

[31]Latvia increased its export share sharply in the agricultural sector.

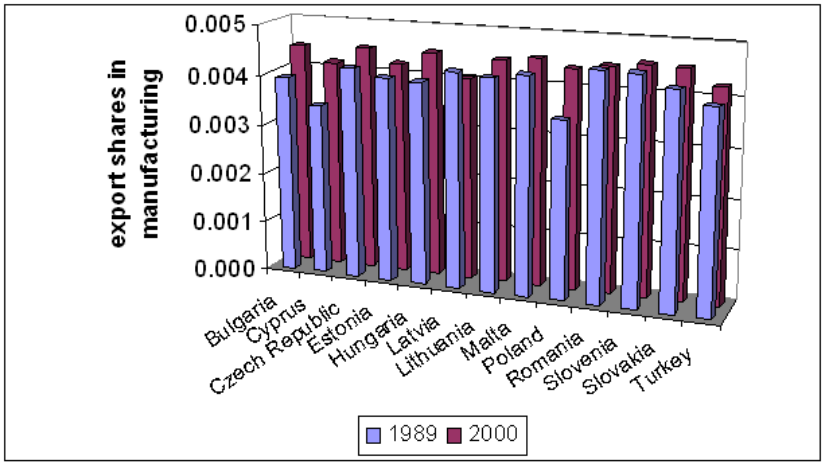


Figure 4.7: Average export share in manufacturing sector in Central Europe

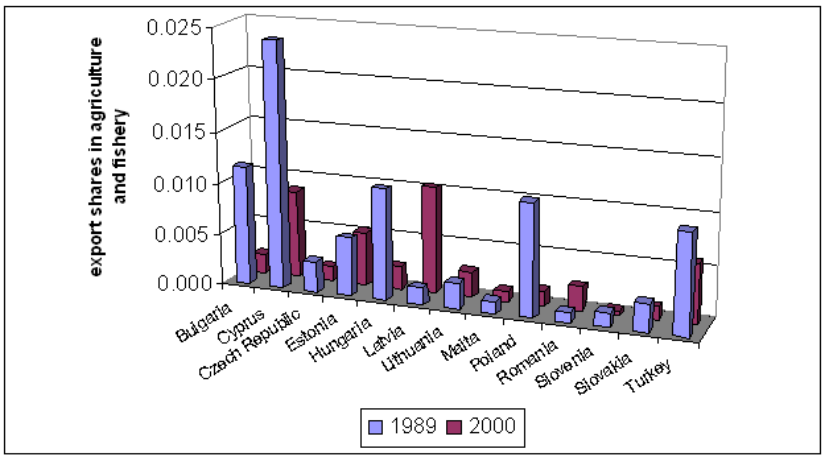


Figure 4.8: Average export share in agriculture sector in Central Europe

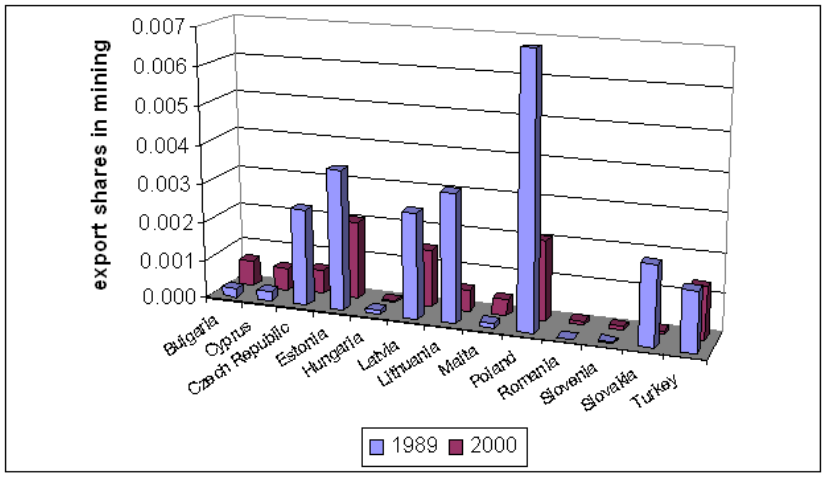


Figure 4.9: Average export share in mining sector in Central Europe

Table 4.5: Change in the composition of exports, 1989-2000

	Bulgaria	Cyprus	Czech Rep.	Estonia	Latvia
Hoekman & Djankov (1997)	0.41		0.58		
Our results	0.4	0.65	0.52	0.49	0.34
	Malta	Hungary	Poland	Romania	Slovakia
Hoekman & Djankov (1997)		0.89	0.80	0.32	0.68
Our results	0.55	0.43	0.55	0.33	0.11
	Lithuania	Slovenia	Turkey		
Hoekman & Djankov (1997)					
Our results	0.22	0.63	0.71		

A study by Amiti & Konings (2007) analyzed the effect of reducing tariffs on firm productivity in Indonesia. In their study they distinguished between input and output tariffs. Their results show that reducing input tariffs significantly increases productivity of domestic firms and that this increase is much higher than reducing tariffs on final good imports. We do not have such a detailed data set as in Amiti & Konings (2007), but we can observe in which sectors, tariffs decreased the most. Figure 4.10 reports the tariff reductions in the period 1989-2000 per sector at 2-digit level NACE code. We observe that tariff reductions are higher in the manufacturing sector than in services.

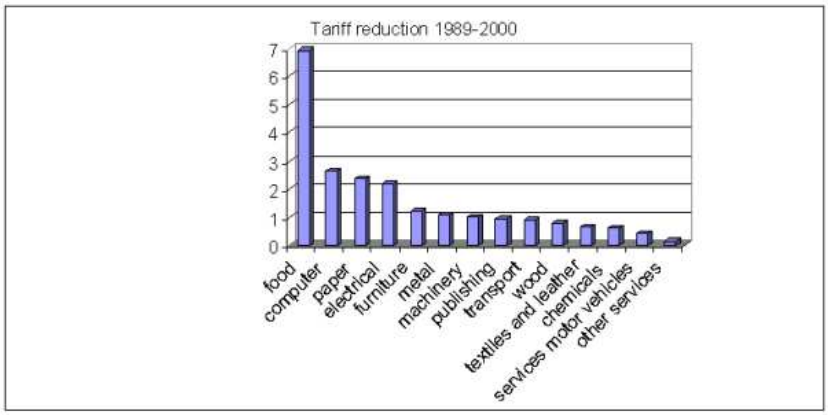


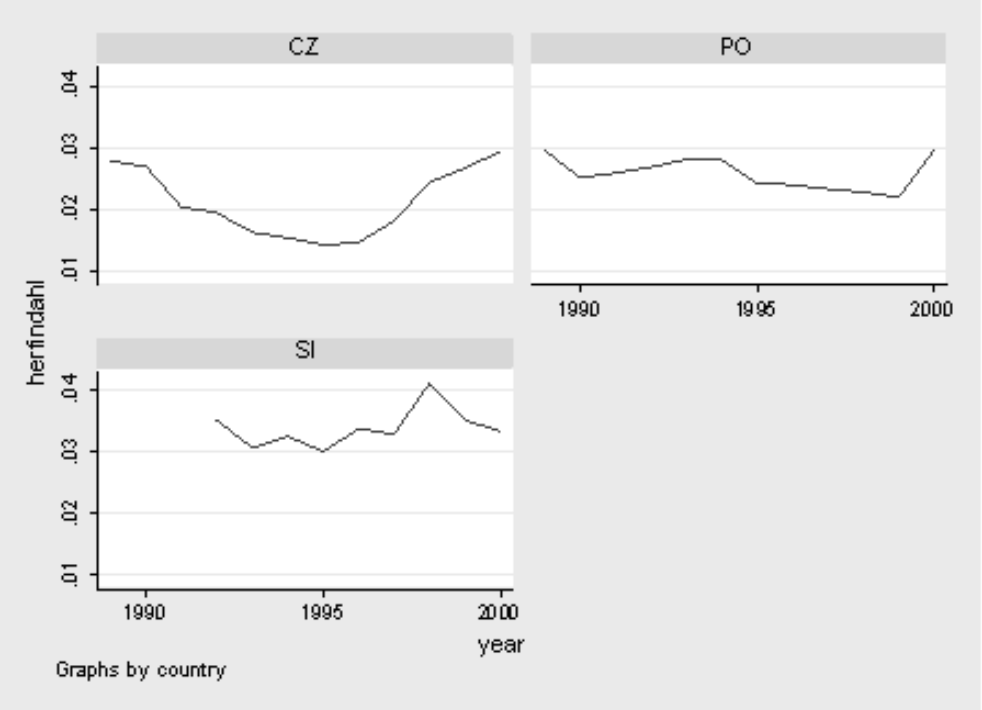
Figure 4.10: Tariff reductions by sector, 1989-2000

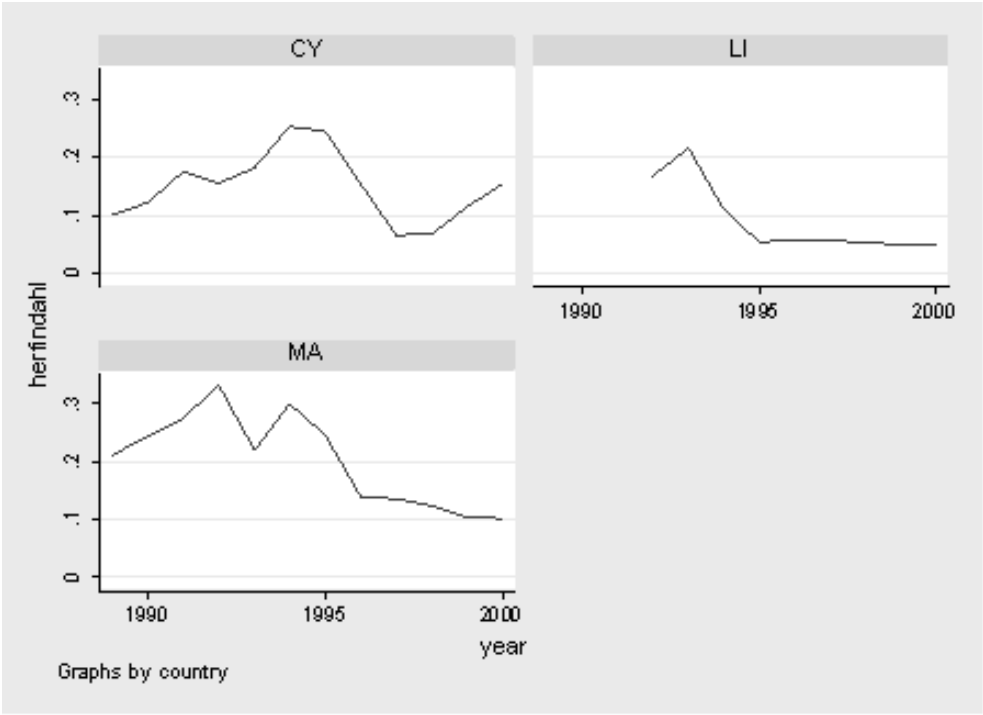
4.9 Conclusion

This chapter analyzed whether the trade integration process between the EU15 and Central Europe has led to more export specialization in Central Europe. Moreover, we studied whether corporate taxes and institutional reforms in Central Europe influenced export specialization. During the period 1989-2000, we observed a gradual decline in EU15 tariffs on exports from Central and East European countries (CEECs). Also effective tax rates decreased from 1997 onwards and institutional reforms in Central Europe increased rapidly as a result of the transition process from a centrally

planned to a market economy. We focused on two types of institutional reforms: enterprise reforms and competition policy reforms. Both variables indicate to what extent Central Europe restructured its institutions to more market economy oriented standards. Enterprise reforms include credit and subsidy policies for firms, while competition policy reforms consist of abolishing entry restrictions and dominant market power. The impact of EU15 tariffs, taxes and institutional reforms on export specialization in Central Europe was analyzed using a dynamic panel model. This model enables us to disentangle between a short run and a long run effect of tariffs. The results indicate a positive effect of tariffs on export specialization in the long run. Corporate taxes and competition policy reforms do not seem to have an effect on export specialization. In contrast enterprise reforms play a significant role. An increase of enterprise reforms by one unit leads to an increase of about 28% in export specialization. This implies that both trade integration with the EU15 as enterprise reforms stimulate export specialization in Central and Eastern Europe.

4.10 Appendix A

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1990
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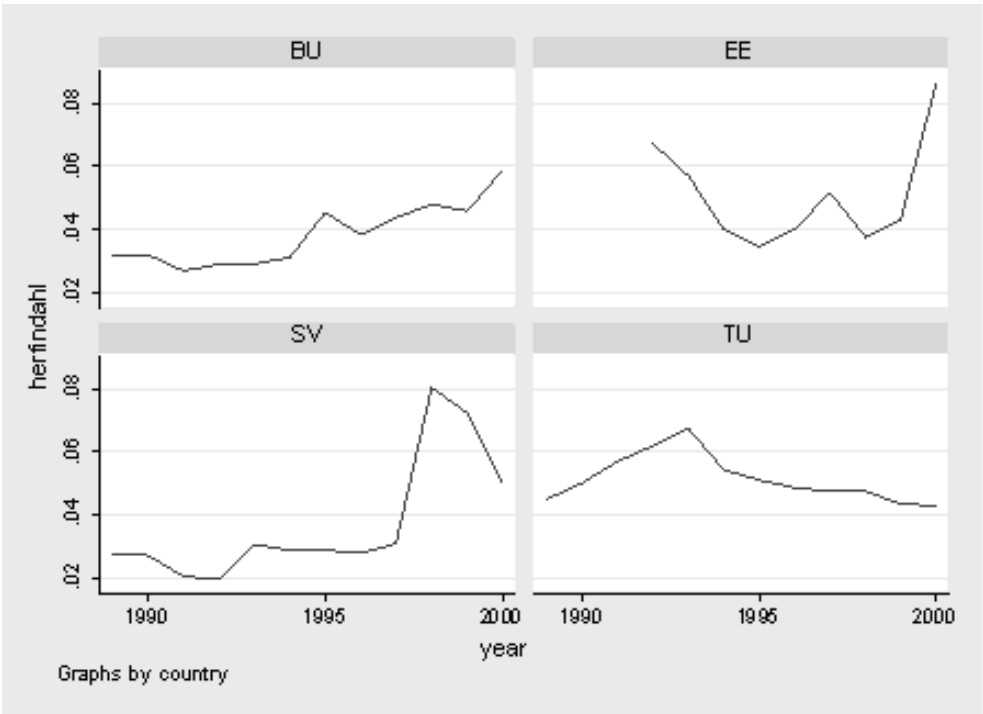
Graphs by country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1990
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year
Graphs by country

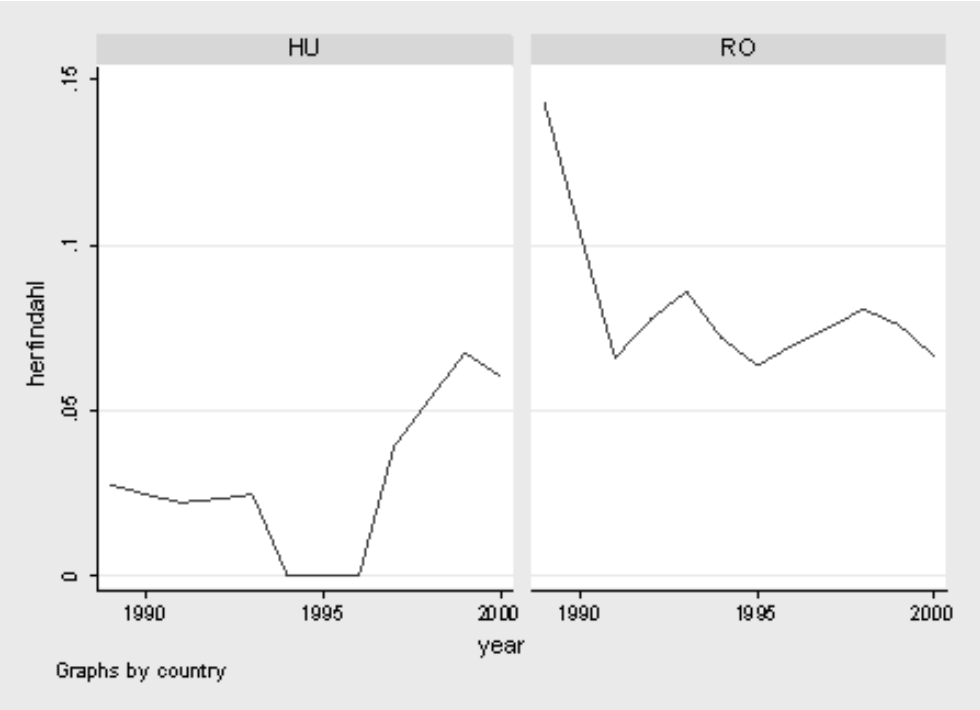


Figure 4.11: Herfindahl index per country

Source: Eurostat

4.11 Appendix B

As an alternative to the tariff variable, two EBRD indicators on trade and price liberalization are used. These indicators lie between 1 and 4.33 according to their achievement in reforms. The classification system for the trade liberalization and price liberalization reforms are as follows:

Table 4.6: Trade liberalization

score	Trade liberalization reforms
1	if there are widespread import and/or export controls or very limited legitimate access to foreign exchange.
2	if there is some liberalization of import and/or export controls; almost full current account convertibility in principle, but with a foreign exchange regime that is not fully transparent (possibly with multiple exchange rates).
3	if almost all quantitative and administrative import and export restrictions are removed and there is almost full current account convertibility.
4	if all quantitative and administrative import and export restrictions are removed (apart from agriculture) and all significant export tariffs; insignificant direct involvement in exports and imports by ministries and state-owned trading companies; no major non-uniformity of customs duties for non-agricultural goods and services; full and current account convertibility.
4.33	if there are standards and performance norms of advanced industrial economies: removal of most tariff barriers; membership in WTO.

Table 4.7: Price liberalization

score	Price liberalization reforms
1	if most prices are formally controlled by the government.
2	if there is some lifting of price administration; state procurement at non-market prices for the majority of product categories.
3	if significant progress has been made on price liberalization, but state procurement at non-market prices remains substantial.
4	if there is comprehensive price liberalization; state procurement at non-market prices largely phased out; only a small number of administered prices remain.

Source: EBRD; Note: EBRD indicators are not available for Malta, Cyprus and Turkey.

4.12 Appendix C

Methodology:
Equation 4.1 is an error correction model without explicitly including an error correction term in the form of

$$\triangle y_t = \alpha + \varphi_1 y_{t-1} + \varphi_2 X_{t-1} + \varphi_3 \Delta X_t + \epsilon_t \tag{4.6}$$

This model can be rewritten in an error correction form as follows:

$$\triangle y_t = \alpha + \varphi_1 [y_{t-1} - (\frac{-\varphi_2}{\varphi_1}) X_{t-1}] + \varphi_3 \Delta X_t \tag{4.7}$$

φ_1 can be interpreted as the speed at which export specialization adjusts to any difference between export specialization and tariffs in the previous period. The short-run effect, the immediate effect that tariffs have on export specialization, is represented by φ_3. The causal effect that occurs over future periods, long-run effect is reflected by $-\frac{\varphi_2}{\varphi_1}$.

Table 4.8: Enterprise and competition policy reforms data

	Bulgaria		Czech Republic		Estonia	
year	competition	enterprise	competition	enterprise	competition	enterprise
1989	2	1	3	3	1	1
1990	2	1	3	3	1	1
1991	2	1	3	3	1	1
1992	2	1	3	3	1	2
1993	2	1	3	3	2	3
1994	2	2	3	3	2	3
1995	2	2	3	3	2	3
1996	2	2	3	3	2	3
1997	2.3	2.3	3	3	2	3
1998	2.3	2.3	3	3	2	3
1999	2.3	2.3	3	3	2.7	3
2000	2.3	2.3	3	3.3	2.7	3
	Hungary		Latvia		Lithuania	
year	competition	enterprise	competition	enterprise	competition	enterprise
1989	3	3	1	1	1	1
1990	3	3	1	1	1	1
1991	3	3	1	1	1	1
1992	3	3	2	2	1	1
1993	3	3	2	2	2	2
1994	3	3	2	2	2	2
1995	3	3	2	2	2	2
1996	3	3	2	3	2	2
1997	3	3	2.3	2.7	2.3	2.3
1998	3	3.3	2.3	2.7	2.3	2.7
1999	3	3.3	2.3	2.7	2.3	2.7
2000	3	3.3	2.3	2.7	2.7	2.7

	Poland		Romania		Slovenia	
year	competition	enterprise	competition	enterprise	competition	enterprise
1989	3	3	1	1	2	3
1990	3	3	1	1	2	3
1991	3	3	1	1	2	3
1992	3	3	1	1	2	3
1993	3	3	1	2	2	3
1994	3	3	1	2	2	3
1995	3	3	1	2	2	3
1996	3	3	1	2	2	3
1997	3	3	2.3	2	2	2.7
1998	3	3	2.3	2	2.3	2.7
1999	3	3	2.3	2	2.3	2.7
2000	3	3	2.3	2	2.7	2.7

	Slovakia	
year	competition	enterprisereform
1989	3	3
1990	3	3
1991	3	3
1992	3	3
1993	3	3
1994	3	3
1995	3	3
1996	3	3
1997	3	2.7
1998	3	2.7
1999	3	3
2000	3	3

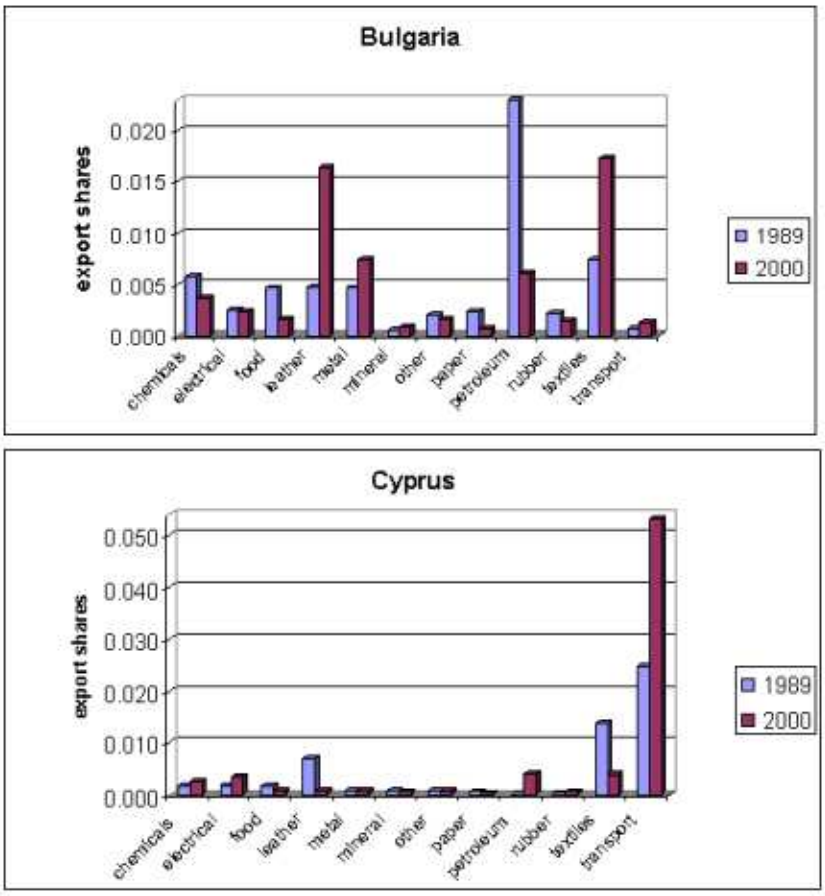
Table 4.9: Correlation matrix

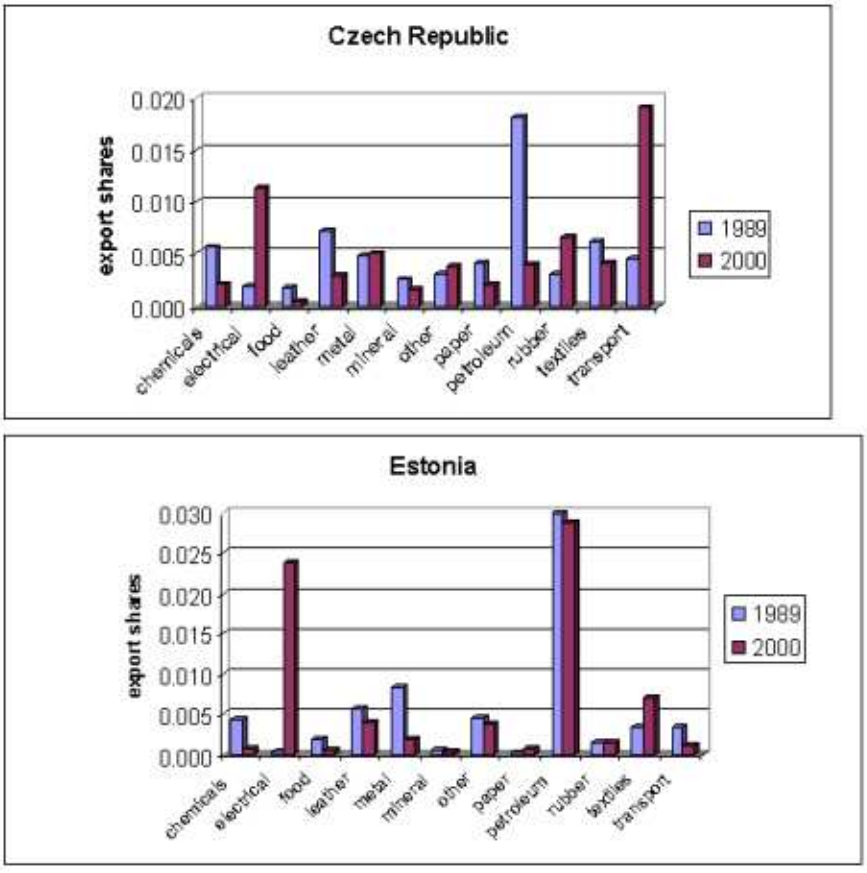
	Δlog $(Exp\ spec)$	$log(Exp\ spec)_{t-1}$	$logtariff)_{t-1})$	Δlog $(tariff)$	bus. cycle	EU-bus. cycle	HIB
$\Delta log(Exp\ spec.)$	1	-0.31	-0.11	-0.24	-0.05	-0.07	-0.04
$log(Export\ spec.)_{t-1}$	-0.31	1	0.48	0.23	0.03	-0.14	-0.18
$log(tariff)_{t-1}$	-0.11	0.48	1	-0.05	0.09	-0.04	0.01
$\Delta log(tariff)$	-0.24	0.23	-0.05	1	-0.07	0.07	0.07
business cycle	-0.05	0.03	0.09	-0.07	1	0.08	0.004
EU-business cycle	-0.07	-0.14	-0.04	0.07	0.08	1	0.88
HIB	-0.04	-0.18	0.01	0.07	0.005	0.88	1
competition policy reform	0.18	-0.57	-0.82	-0.08	0.08	0.05	-0.002
enterprise reforms	0.15	-0.48	-0.68	-0.13	-0.1	0.06	0.09
price liberalization	0.22	-0.03	-0.27	-0.03	-0.18	0.03	0.06
trade liberalization	0.16	-0.28	-0.29	-0.13	0.0001	-0.02	0.05

Table 4.10: Correlation matrix, continued

	comp. policy ref.	enterp. ref.	price lib.	trade lib.
$\Delta log(Exp\ spec.)$	0.18	0.15	0.16	0.16
$log(Export\ spec.)_{t-1}$	-0.57	-0.48	-0.03	-0.28
$log(tariff)_{t-1}$	-0.82	-0.68	-0.27	-0.29
$\Delta log(tariff)$	-0.08	-0.12	-0.03	-0.13
business cycle	0.08	-0.1	-0.18	0.0001
EU-business cycle	0.05	0.06	0.03	-0.02
HIB	-0.002	0.09	0.06	0.05
competition policy reform	1	0.72	0.4	0.54
enterprise reforms	0.72	1	0.47	0.57
price liberalization	0.4	0.47	1	0.46
trade liberalization	0.54	0.57	0.46	1

4.13 Appendix D

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export shares
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0.015
0.010
0.005
0.000
1989
2000
chemicals
electrical
food
leather
metal
mineral
other
paper
petroleum
rubber
textiles
transport
Estonia
export shares
0.030
0.025
0.020
0.015
0.010
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1989
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chemicals
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leather
metal
mineral
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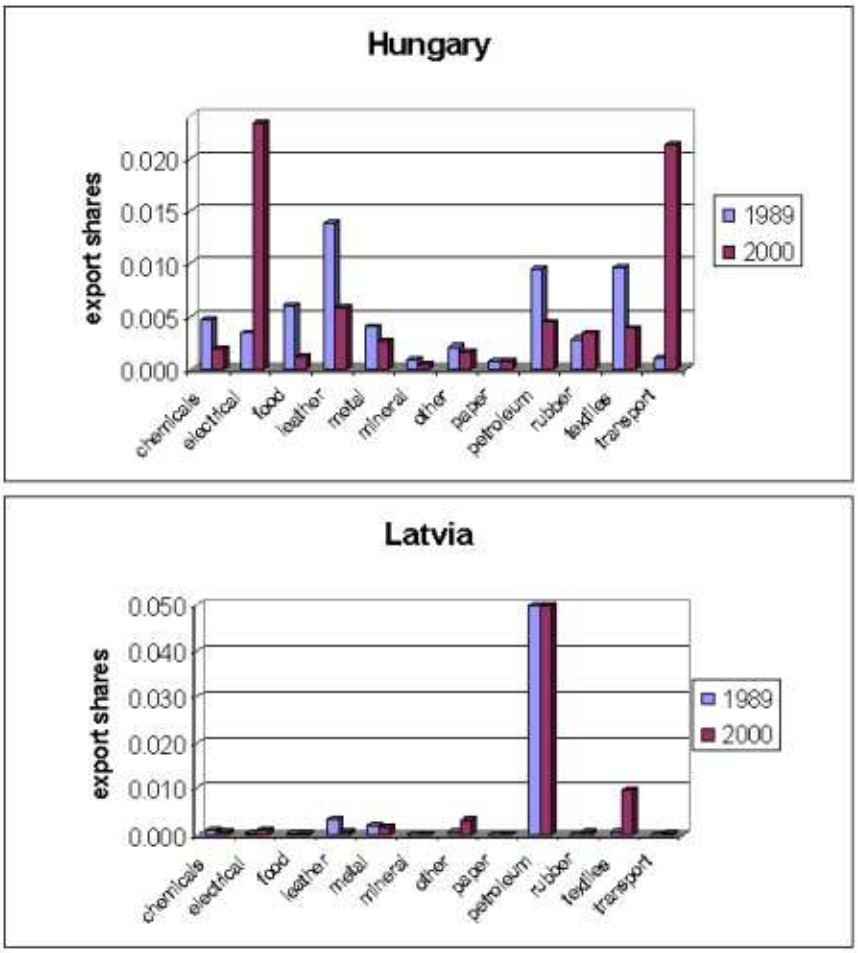
petroleum
rubber
textiles
transport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0.015
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2000
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leather
metal
mineral
other
paper
petroleum
rubber
textiles
transport
Latvia
export shares
0.050
0.040
0.030
0.020
0.010
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1989
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leather
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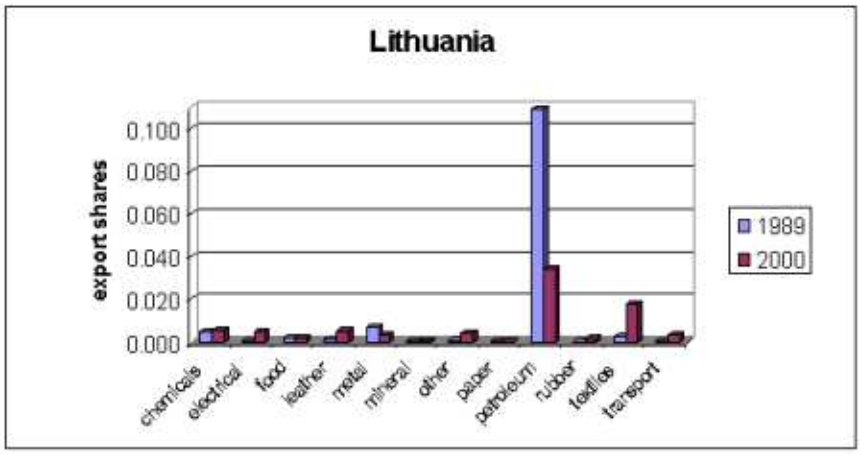
textiles
transport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export shares
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0.080
0.060
0.040
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chemicals
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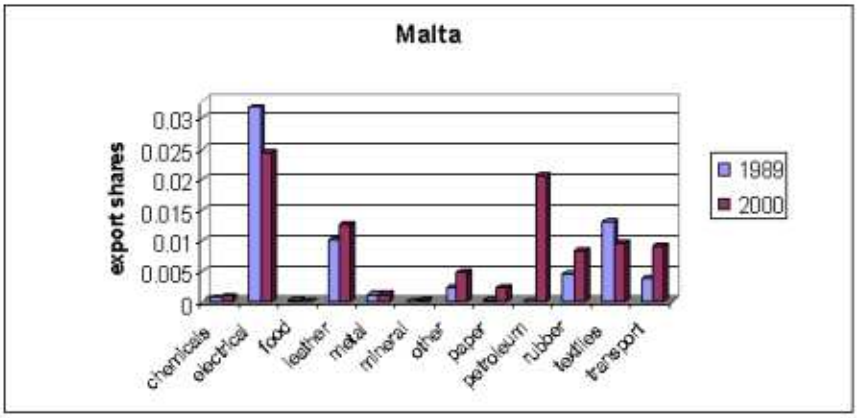
mineral
other
paper
petroleum
rubber
textiles
transport
1989
2000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export shares
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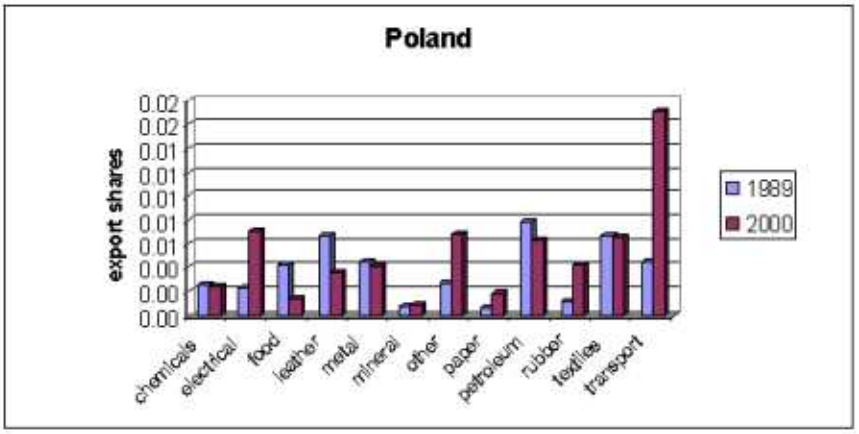
0.025
0.02
0.015
0.01
0.005
0
chemicals
electrical
food
leather
metal
mineral
other
paper
petroleum
rubber
textiles
transport
1989
2000


Poland
export shares
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0.02
0.01
0.01
0.01
0.01
0.01
0.00
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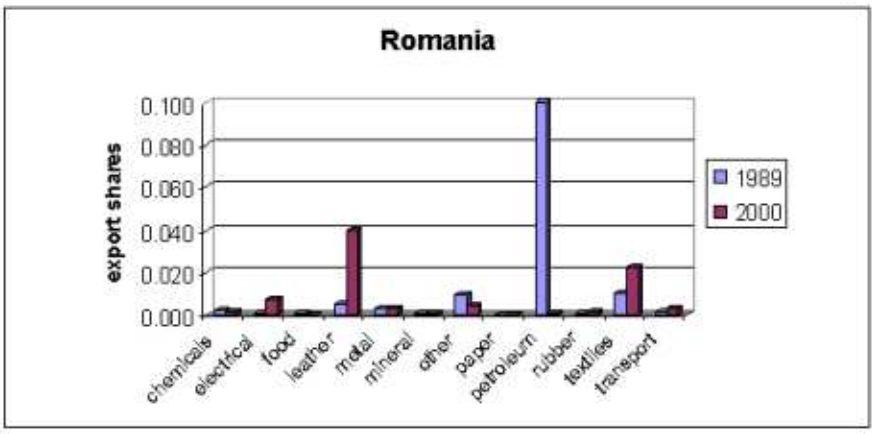
metal
mineral
other
paper
petroleum
rubber
textiles
transport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0.080
0.060
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petroleum
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textiles
transport

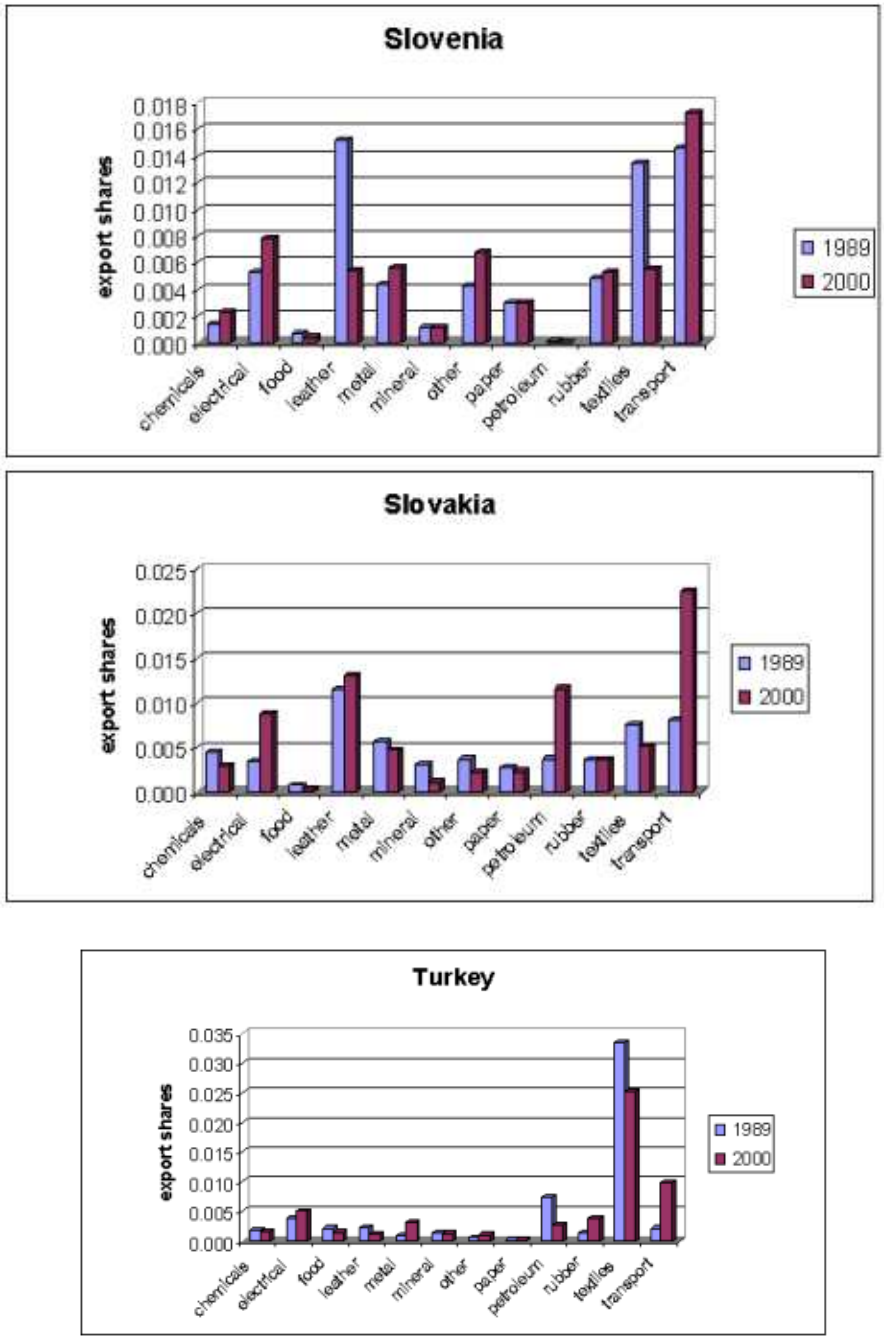

Figure 4.12: Export shares per country within manufacturing

General Conclusion

This dissertation studied corporate tax competition from a regional and a country perspective. Although corporate taxes are set at the national level, the effective tax can differ across regions because of the variety of tax rules, regional enforcement of the tax law or strategic tax competition between regions. The main contribution of this thesis is empirical. Chapter 1 analyzed the impact of firm characteristics, sectors and regions on the effective tax rate of large Belgian firms. The results reveal that during the period 1993-2002, the effective tax rate of Walloon firms is about 6 percent lower than the effective tax rate of Flemish firms. Another observation was that Belgium follows the European trend of increasing effective tax rates and decreasing statutory tax rates. In general, the average effective tax rate during the period was 26%, indicating that large Belgian firms benefited from tax advantages of approximately 14%[32]. A next step in regional tax differences is analyzing strategic interactions between regions. Therefore, chapter 2 looked at strategic interactions in corporate tax setting in Italian regions for the period 1993-2003. The findings show that southern and mountain areas in Italy have on average a lower effective tax rate than the Northern region and that Italian regions set their corporate tax rates taking into account the tax rate of related regions.

In a third chapter I tackled the question whether there is corporate tax competition between EU countries. By setting up a two-country model, I showed that there exists an inverse relation between distance and the intensity of tax competition. Empirically, the results confirmed that tax competition is indeed stronger for EU countries located relatively closer to the

[32]The statutory tax rate for large Belgian firms during the period 1993-2002 was 40.17%.

new member states, like Germany or Austria than for EU countries further away from the new member states, such as the UK and Portugal. A final chapter looked at corporate taxes from a different perspective. Chapter 4 analyzed the impact of trade integration, institutions and corporate taxes on export specialization in Central and Eastern Europe during the period 1989-2000. The results show a positive effect of tariffs and enterprise reforms, in terms of correct credit and subsidy policies for firms, on export specialization. Surprisingly, I do not find evidence of the role of corporate taxes.

In conclusion, this dissertation shows that corporate tax competition is not confined to countries but is a phenomenon that can be observed at the regional level within EU countries. While the corporate tax rate are set at the country level, effective tax rates which measure tax expenses taking into account the size of the tax base show large differences across regions within one country. In addition, this study provides evidence of a spatial dimension in corporate tax competition between the EU15 and the new member states.

Recently, several measures and proposals are provided to increase the transparency of the corporate tax system and reduce discriminatory tax regimes within Europe. The European Commission exposed 66 tax regimes in the European Union as harmful tax competition. The reason was that these regimes were discriminatory, influenced the location of economic activity and disturbed the European internal market. As a consequence, these tax regimes needed to be abolished or reformed. The policy implications of this dissertation suggest that also regional tax differences within one country are present, suggesting that sectors and location within one country are stimulated through tax incentives, such that the location of economic activity is influenced and firms are discriminated. The European commission proposed a single corporate tax base for all EU-wide activities of European multinational enterprises (a common consolidated tax base) to eliminate profit shifting and tax obstacles. A similar measure could be introduced for companies with affiliates in different regions within one country, fiscal consolidation on a country level can help offsetting of losses in one region against profits in another region and eliminate regional profit shifting. Moreover, the introduction of Central and Eastern European countries has changed the

spatial pattern of tax competition. The results of this dissertation suggest that tax competition between EU15 countries and the new member states is stronger than tax competition amongst the EU15 during the period 1993-2006.

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Nederlandstalige Samenvatting

Dit doctoraat behandelt een vergelijkende empirische studie van vennootschapsbelastingconcurrentie zowel op regionaal als op Europees niveau. Niet alleen landen verschillen onderling, maar ook regio's binnen één land kunnen grote economische verschillen vertonen. Dit doctoraat bestaat uit vier hoofdstukken. De eerst twee hoofdstukken bestuderen regionale belastingsverschillen binnen één land. België en Italië worden als voorbeeld genomen in deze studies omwille van hun sterk verschillende regio's. Ondanks het feit dat de vennootschapsbelasting een federale materie is in deze landen, kan de effectieve belastingdruk van bedrijven en regio's sterk verschillen. Mogelijke redenen zijn de complexiteit van de belastingregels, belastingsaftrekken voor bepaalde ondernemingen of investeringen in bepaalde regio's en voordelige belastingsregimes. Een derde hoofdstuk onderzoekt belastingconcurrentie tussen Europese landen onderling. Tenslotte, behandelt hoofdstuk vier de invloed van belastingen, economische integratie en instituties op export specialisatie in Centraal- en Oost-Europa.

Een eerste hoofdstuk in dit doctoraat bestudeert regionale belastingsverschillen in België. Deze studie, die uitgevoerd werd met gegevens van 12167 jaarrekeningen van grote Belgische ondernemingen, komt tot de conclusie dat de feitelijke belastingdruk van een gemiddeld Belgisch bedrijf 26% in plaats van 40.17% bedroeg tijdens de periode 1993-2002. Ook wijzen de resultaten erop dat de feitelijke belastingdruk tussen 1993 en 2002 gestegen is en dan vooral vanaf 1999. Een mogelijke verklaring is dat de overheid vanaf 1999 de belastbare basis verbreed heeft om in december 2002 het be-

lastingtarief te kunnen verlagen tot 33.99%. Dit is een fenomeen dat ook in andere Europese landen geobserveerd wordt, namelijk het samengaan van een verlaging van de belastingvoet enerzijds maar een uitbreiding van de belastbare grondslag anderzijds om het effect op de begroting van het land te neutraliseren. De resultaten wijzen ook uit dat Waalse en Brusselse bedrijven relatief minder belastingen betalen dan Vlaamse bedrijven. Dit betekent dat er geen sprake is van belastingneutraliteit in België met betrekking tot de locatie van een bedrijf. Vervolgens gaat hoofdstuk twee een stap verder en analyseert of regionale belastingsverschillen in Italië tot stand komen omwille van strategische interactie tussen regio's. Aan de hand van een reactiefunctie kunnen we uitzoeken of de regio's hun effectieve belastingdruk individueel wijzigen of hierbij rekening houden met de effectieve belastingdruk van andere regio's. De resultaten wijzen uit dat regio's reageren op wijzigingen in de effectieve belastingdruk van aangrenzende regio's. Bovendien wordt Italië gekenmerkt door een groep van regio's met een gemiddeld hogere BBP, betere infrastructuur en publieke voorzieningen en een groep van regio's met een lagere BBP en een tragere industrievorming. De effectieve belastingdruk in de eerste groep is bijgevolg 7 procentpunten hoger dan in de laatste groep van regio's. Uit deze twee hoofdstukken kunnen we besluiten dat belastingsverschillen ook op regionaal niveau bestaan en dat regio's hun belastingen strategisch bepalen door rekening te houden met de effectieve belastingdruk van gerelateerde regio's.

Het derde hoofdstuk bevat een studie die belastingconcurrentie in de EU onderzoekt waarbij voor het eerst rekening wordt gehouden met de nieuwe lidstaten. Deze studie ontwikkelt eerst een theoretisch kader om de rol van afstand in vennootschapsbelastingconcurrentie te verklaren. Vervolgens wordt dit model empirisch getest door de reactie van de EU15 landen op wijzigingen in de belastingsvoet van de nieuwe lidstaten te meten. Hierbij wordt rekening gehouden met de afstand van de EU15 landen tot de nieuwe lidstaten. De resultaten geven aan dat de geografische ligging tegenover de nieuwe lidstaten inderdaad een rol speelt in Europese belastingconcurrentie. Landen uit de EU15 zoals Duitsland en Oostenrijk die op een kortere afstand tot de nieuwe lidstaten liggen, ondervinden een grotere druk om hun belastingvoet te laten dalen om geen bedrijven te verliezen aan deze

Oost-Europese lidstaten.

Tenslotte, analyseert hoofdstuk vier het effect van economische integratie met de EU15, instituties en belastingen op exportspecialisatie in Centraal- en Oost-Europa. Aangezien een verregaande exportspecialisatie een grotere afhankelijkheid betekent van enkele sectoren, verhoogt dit het risico op nefaste gevolgen van een vraagschok. Vooral met het oog op een mogelijke toetreding tot de EMU waar het individuele monetaire beleid naar Europees niveau geschoven wordt, kunnen sector-specifieke schokken tot drastische gevolgen leiden. Daarom is het van belang om exportspecialisatie van de nieuwe EU lidstaten te observeren. Deze studie toont aan dat tijdens de periode 1989-2000, de exportspecialisatie van Centraal- en Oost-Europa toeneemt naarmate de tarieven van de EU15 op import van 13 Centraal- en Oost-Europese landen dalen. Bovendien neemt exportspecialisatie in deze landen ook toe naarmate er meer geïnvesteerd wordt in instituties die markt-gedreven krediet-en faillissementregels ontwikkelen en 'corporate governance' in ondernemingen versterken. Er is geen effect gevonden van vennootschapsbelasting op export specialisatie.

Samengevat, besluit dit doctoraat dat belastingsverschillen niet alleen tussen landen, maar ook op regionaal vlak bestaan. Bedrijven zijn bereid om een hogere vennootschapsbelasting te betalen in regio's met een sterk ontwikkeld infrastructuurnetwerk en publieke voorzieningen. Bovendien reageren regio's strategisch op wijzigingen in de effectieve belastingdruk van gerelateerde regio's. Er werd ook vastgesteld dat er een geografisch patroon in belastingconcurrentie aanwezig is, waarbij landen op een kortere afstand van de nieuwe lidstaten zoals Duitsland en Oostenrijk, meer invloed van deze landen ondervinden dan landen op een verdere afstand, zoals België en Nederland. In een laatste studie werd vastgesteld dat de vennootschapsbelasting geen rol speelt in de exportspecialisatie van Centraal- en Oost-Europa. Daarentegen zorgen economische integratie en de kwaliteit van instituties wel voor een sterke exportspecialisatie in Centraal- en Oost-Europa.

Ter afronding, kunnen uit deze thesis enkele beleidsimplicaties afgeleid worden. In 1999, besloot de Europese Commissie dat 66 fiscale regimes schadelijke belastingconcurrentie inhielden. Deze regimes bevoordeelden een aparte groep ondernemingen, beïnvloedden de locatie van economische ac-

tiviteiten in de EU en kortom de werking van de interne markt. Als gevolg werden deze fiscale regimes afgeschaft of hervormd. De resultaten van dit doctoraat tonen aan dat er ook regionale belastingverschillen mogelijk zijn zodat bepaalde sectoren en regio's via de vennootschapsbelasting gestimuleerd of afgeremd worden en dus ook de locatie van economische activiteiten beïnvloeden. De Europese Commissie stelt ook voor om een geconsolideerde belastbare basis voor Europese multinationale ondernemingen in te voeren. Een gelijkaardige maatregel op nationaal niveau voor bedrijven met filialen in verschillende regio's kan ook reeds op nationaal vlak winstverschuivingen inperken. Verder heeft de toetreding van enkele Centraal- en Oost-Europese landen het geografisch patroon van belastingconcurrentie in de EU veranderd. De resultaten van dit doctoraat suggereren dat belastingconcurrentie tussen de EU15 landen en de nieuwe lidstaten sterker is dan belastingconcurrentie tussen de EU15 landen onderling.

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